WATER WORKS & SEWERAGE

GILLETTE ABP ABC PUBLICATION

EDITOR

SEPTEMBER 1937
VOLUME 84, No. 9

Poland Spring
MAINE

AT THE NEW ENGLAND W.W.A.

a hearty welcome awaits you

Here is an opportunity for Water Works men to visit a water supply that really is different. From Poland Spring, water internationally famed for its curative properties is shipped to every civilized country in the world. The entire bottling process, from the source of supply, through glass and silver tubes, into the bottles, can be watched through plate glass walls of the bottling house. That is only one of the New England Convention attractions—others are as limitless as the spring water from which the spa takes its name.

Poland Spring, easy to reach by rail or motor, is in the heart of New England, where Yankee thrift is again evidenced by the fact that hundreds of towns rely on the accuracy and reliability of Pittsburgh Water Meters.

PITTSBURGH EQUITABLE METER CO
MERCO NORDSTROM VALVE CO.
MAIN OFFICES PITTSBURGH, PA.
ATLANTA BUFFALO CHICAGO
NEW YORK COLUMBIA KANSAS CITY PHILADELPHIA TULSA HOUSTON LOS ANGELES

PITTSBURGH WATER METERS

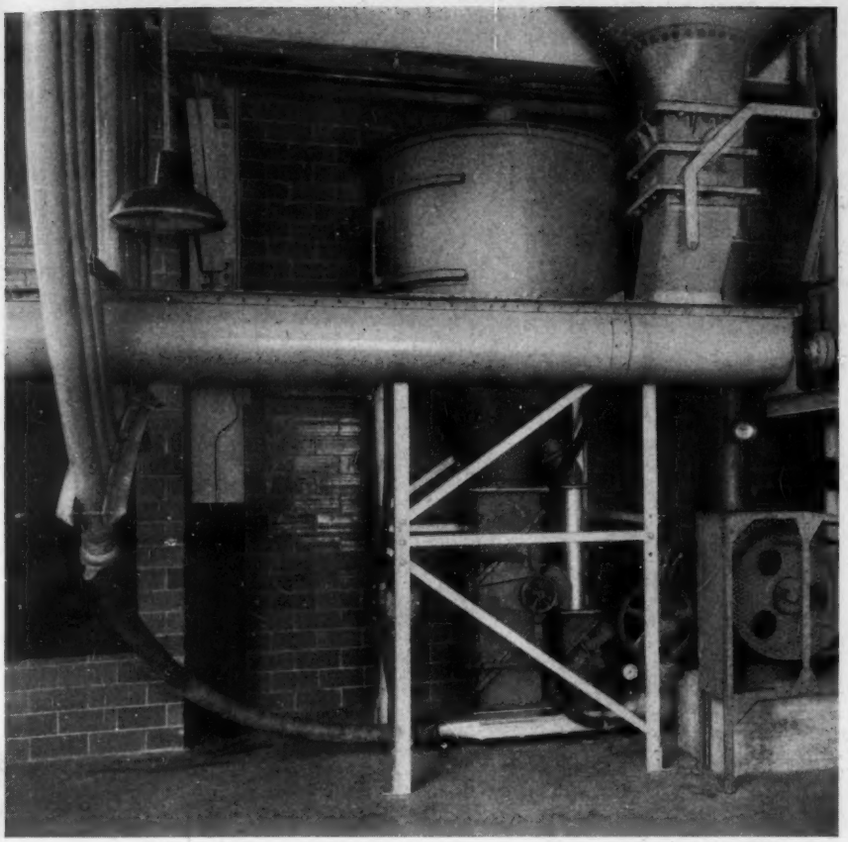
An unusual installation of a sanitary sewer on a tidal flat in California with cast iron pipe used not only for the main but for piles supporting it. Sea water calls for the infiltration-proof joints and effective resistance to corrosion of cast iron pipe. No other practicable material serves as long under such conditions, or has comparable compressive strength. We supply pit cast pipe in all diameters up to 84-inch; Super-de Lavaud *chill-free* centrifugally cast pipe in diameters 24-inch and under. Our technical staff has had years of experience in producing special fittings. Stocks of pipe and fittings at 15 shipping points.

UNITED STATES PIPE AND FOUNDRY COMPANY
BURLINGTON **NEW JERSEY**

Foundries and Sales Offices throughout the United States

U. S. CAST IRON PIPE

for sewers and sewage treatment plants



Airveyor receiver and exhauster unit installed in a mid-western water purification plant. Note the seven-way switch for conveying materials under pressure to seven storage tanks.

For small or large capacities - a few tons an hour to 150 tons an hour

Your unloading and conveying capacities need not be large to warrant the installation of the Airveyor Conveying System for fine, crushed, and granular materials. These systems are installed for requirements ranging from a few tons an hour to the largest capacities of approximately 150 tons an hour.

Large or small, in either case, it may possibly be the solution to some conveying problem you are confronted with in your plant. Our engineering department, with no obligation on your part, will be glad to make studies of your conditions and recommend equipment best suitable for your needs.

Write for bulletin—The Airveyor—for detailed information.

CONVEYING FULLER

FULLER COMPANY
CATASAUQUA, PENNSYLVANIA

Chicago: 1118 Marquette Bldg.
San Francisco: 320-321 Chancery Bldg.

A-16

FULLER-KINYON, FLUXO, AND AIRVEYOR CONVEYING SYSTEMS · · · ROTARY FEEDERS AND DISCHARGE GATES
ROTARY AIR COMPRESSORS AND VACUUM PUMPS · · · AUTOMATIC BATCH WEIGHERS · · · BIN SIGNALS

WATER WORKS AND SEWERAGE, September, 1937, Volume 84, Number 9. Published monthly at 400 West Madison Street, Chicago, Ill., by the Gillette Publishing Company. Per copy, 25c. Subscription rate, $2.00 per year; Canadian and Foreign, $3.00 per year. Copyright, 1937. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

A PRETTY SCENE . . . *(for the Artist)*
but ANOTHER SOURCE *of* TROUBLE *(for the Plant Operator)*

ANOTHER source of worry to the Plant Operator is the high color caused by falling leaves in the raw water supply and during their decomposition the creation of a distinct taste and odor problem.

During the Fall period rains flush out the swampy areas where stagnant water during the summer period has had an opportunity of leaching out the color from the vegetation. This contributes heavily to the color removal problem and to the accompanying intensified taste. The solution of these problems lies in the application of increased coagulation dosage for color removal and NUCHAR for taste and odor removal.

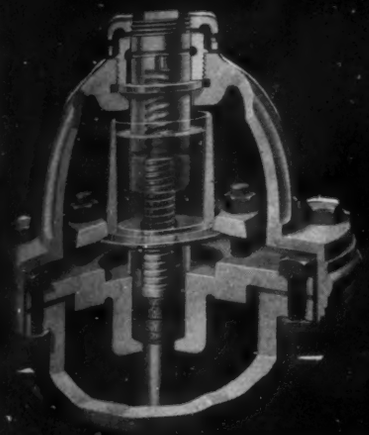
The cost of furnishing palatable drinking water through the use of Activated Carbon is so negligible that every purification plant should consider its continuous use throughout the year.

Make your plans now to attend the Annual Convention of the Southwest Section of the American Water Works Ass'n to be held October 18-21, 1937, at the Hotel Galvez, Galveston, Texas.

INDUSTRIAL CHEMICAL SALES

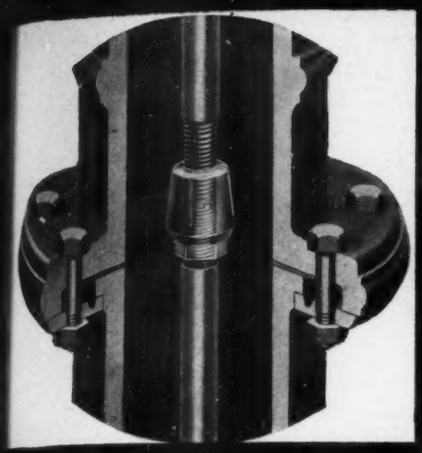
DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

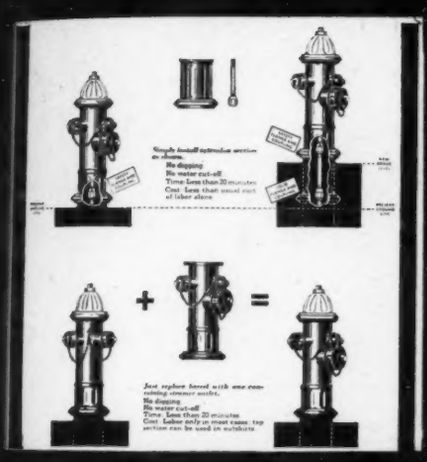
230 Park Avenue, New York City, N. Y.
417 Schofield Building Cleveland, Ohio
205 West Wacker Drive Chicago, Illinois

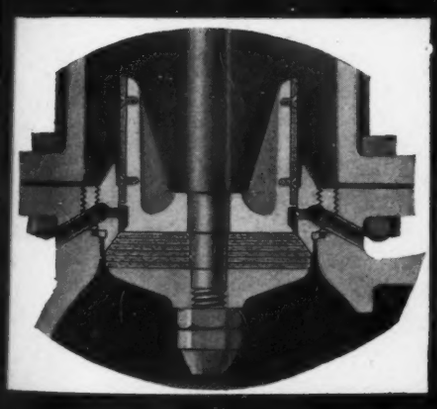


MAKE ANY TEST

FOR ECONOMY OF UPKEEP OR EFFICIENCY OF OPERATION





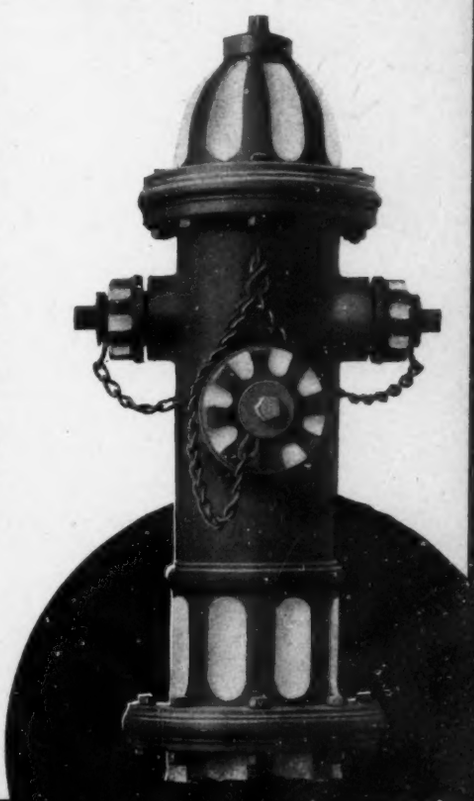


Mueller-Columbian modestly challenges comparison point by point with any other fire hydrant. Compare it for economy of maintenance, for adaptability to meet changing conditions, for efficiency of operation and for low cost repairs. Compare it on ANY basis and you will find this hydrant will win on every point.

For example, this hydrant OILS ITSELF—it needs no periodic attention as all working parts are constantly immersed in an oil bath and are kept free from rust and corrosion. Traffic accidents hold no terror for the Mueller-Columbian. Should the hydrant be hit hard enough to cause damage, the SAFETY-FLANGE parts at the intended spot, protecting all vital parts from damage. It can be repaired in about 30 minutes by one man at a cost of about $5.00 and there is no shut-off or digging. The SAFETY FLANGE also permits easy addition of steamer nozzles or extension to meet changing grade levels. Merely unloosen the bolts and insert a new section. The old section may be placed in stock.

The main valve is of the compression type, faced with chrome tanned leather, noted for durability and long life. No water can possibly remain in the barrel because large bronze bushed double drain valves operate positively when the hydrant is opened and closed. Bronze to bronze contact and water tight copper gaskets prevent corrosion and freezing of threads and permits easy main valve removal. Being of compression type, no shut-off is necessary except when the main valve itself needs repair.

These are some of the "high spots" in the story of this advanced design fire hydrant. The COMPLETE story is yours for the asking. Mail the convenient coupon today.



MUELLER CO.

CHATTANOOGA, TENN.

Mueller Co.,
Dept. A.
Chattanooga, Tenn.
Gentlemen:
Please send me further information on your advanced design fire hydrant.
Name .....
Position ..... State .....
City .....

Like an umbrella for a rainy day

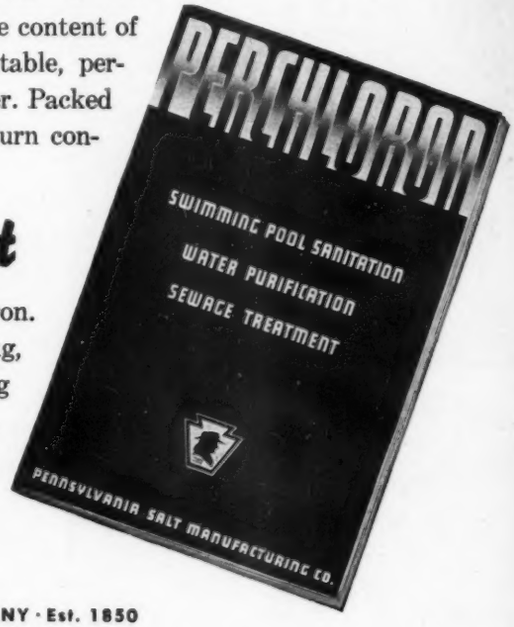
Perchloron

GUARDS AGAINST EMERGENCIES

A strike recently tied up transportation in a large community, preventing normal supplies of liquid chlorine from reaching public swimming pools. Only an unexpectedly prompt settlement of the difficulty kept all pools from closing.

This is but one instance of the type of emergency that can disrupt normal swimming pool sanitation, water purification, or sewage treatment. Without in any way altering your established procedure, you can economically forestall such occurrences by keeping a supply of Perchloron on hand . . . for emergency use.

Perchloron has an available chlorine content of more than 70%. It is concentrated, stable, perfectly uniform. Dissolves readily in water. Packed 12 handy-sized cans to the case—no return containers to bother with.



Get this free booklet

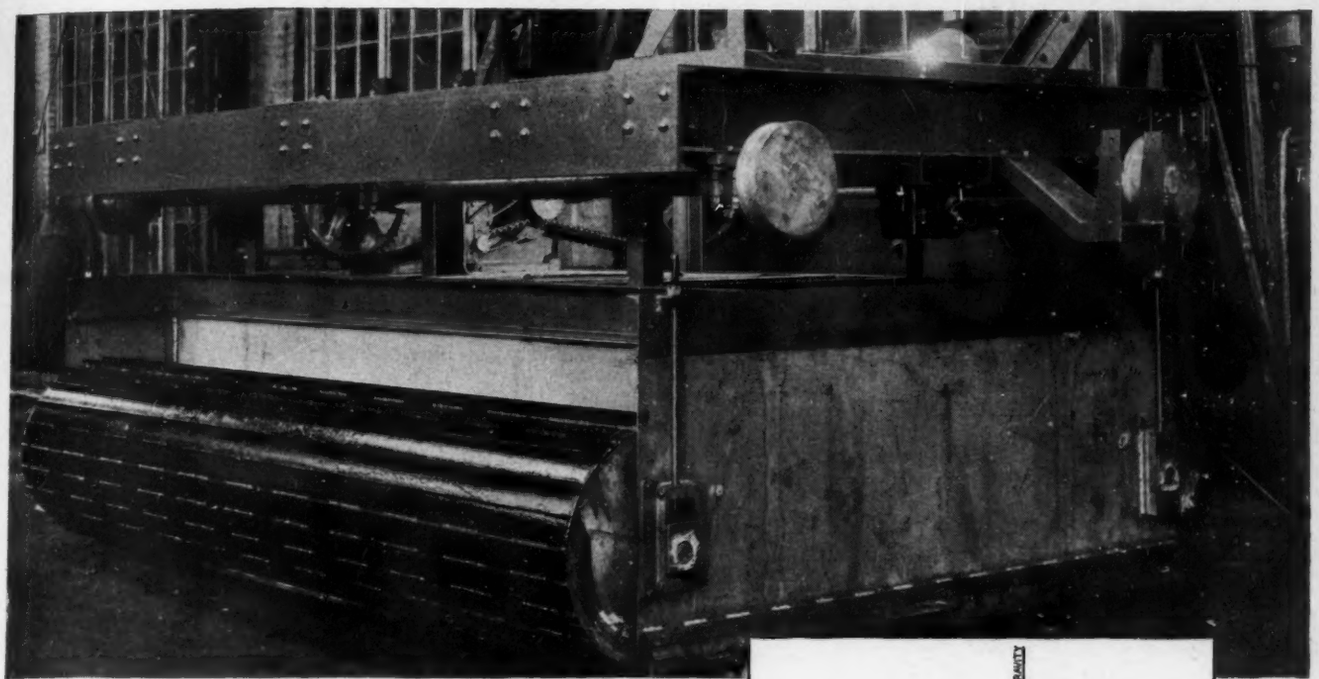
Covers the many important uses of Perchloron. Includes complete data on emergency feeding, determination of residual chlorine, preparing Perchloron solutions, and other points of interest. Keep it on file for general reference. It is free—send for it now.

TRADE MARK

PENNSYLVANIA SALT MANUFACTURING COMPANY · Est. 1850
WIDENER BLDG., PHILADELPHIA, PA.
Offices: New York · Chicago · St. Louis · Pittsburgh · Tacoma · Wyandotte

PENNSYLVANIA SALT *Chemicals*

Fifty-Two Thousand Pounds of **CHASE OLYMPIC BRONZE** in Denver's New Sewage Disposal Plant

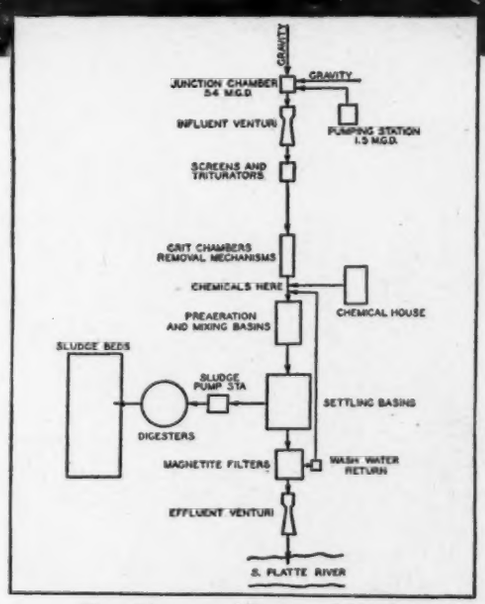


Specified because of its high Corrosion Resistance and Ease of Welding.

In Denver's modern, new Sewage Disposal Plant every care has been taken to maintain its efficiency against the constant inroads of rust.

Filtration Equipment Corporation, the manufacturers, saw to it that the Magnetite Filters were equipped with cleaning boxes of high corrosion resistance—all wire, screens, sheets, plates, bolts and nuts being Chase Olympic Bronze.

When you are planning Sewage Disposal works specify Chase Olympic Bronze. It meets the rigid requirements for corrosion resistant metals, necessary for Sewage Disposal Plants.



Flow Diagram of Denver, Colorado, Chemical Treatment Plant.

CHASE

CHASE OLYMPIC BRONZE

FOR TANK SHEETS . . . STRUCTURAL PARTS . . . FILTER CLOTH

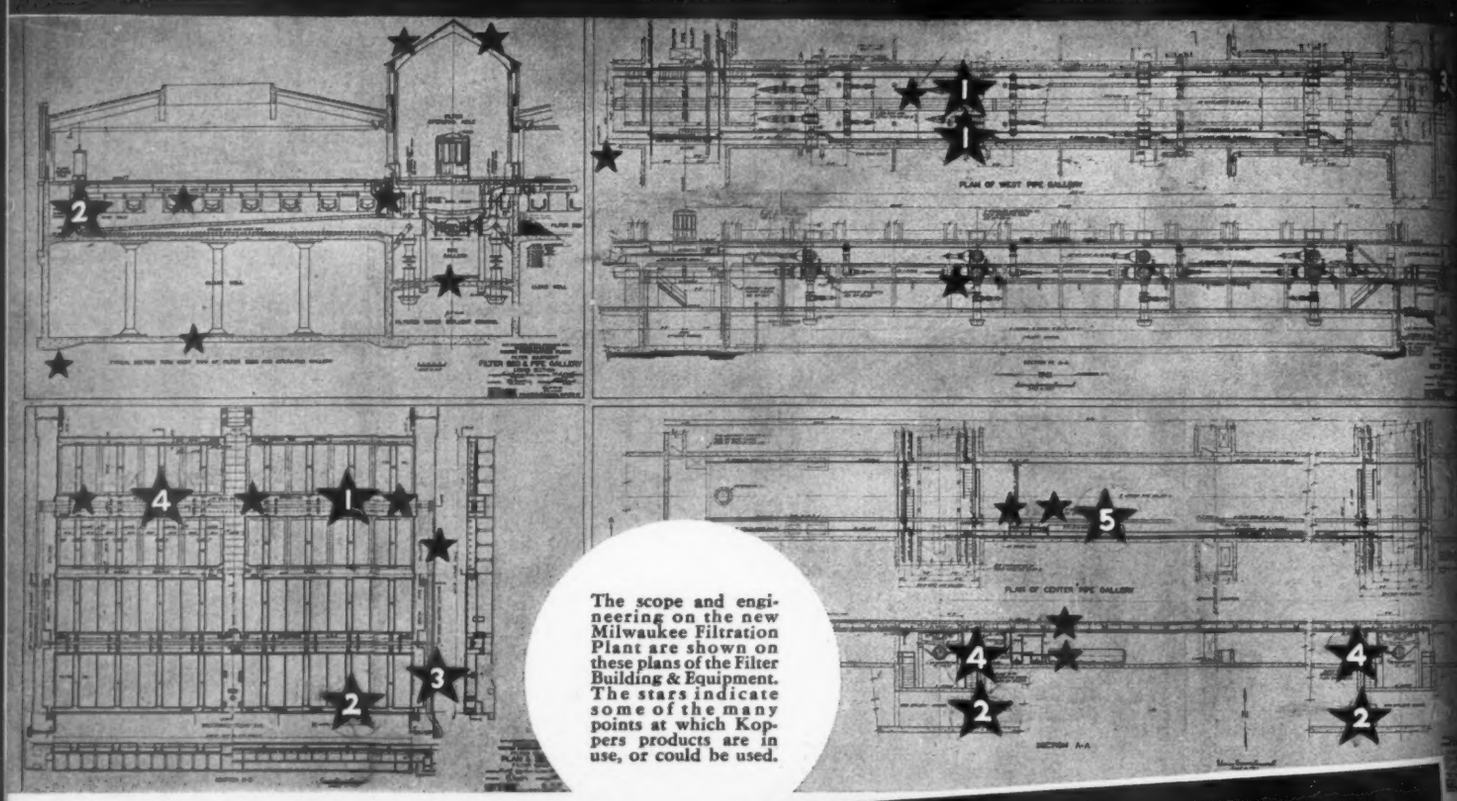
CHASE BRASS & COPPER CO.

—Incorporated—

Subsidiary of Kennecott Copper Corporation

Waterbury Connecticut

KOPPERS



The scope and engineering on the new Milwaukee Filtration Plant are shown on these plans of the Filter Building & Equipment. The stars indicate some of the many points at which Koppers products are in use, or could be used.

WESTERN

GATE VALVES • SLUICE GATES • PIPE

PRODUCTS *Serving the Water Works and Sewerage Fields*

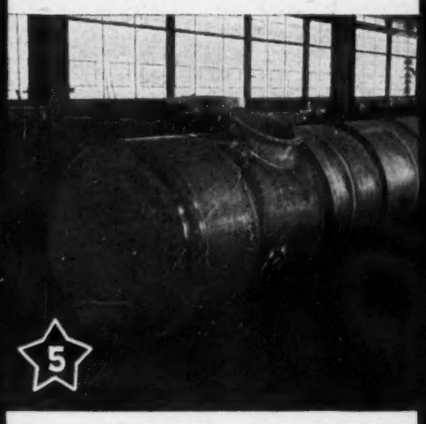
Coal . . . Coal Tar Roofing . . . Creosote . . . Dampproofing . . . Disinfectants . . . Fast's Self-aligning Couplings . . . Fire Hydrants . . . Gas Holders and Dry Purification Systems . . . Insecticides . . . Pipe . . . Piston Rings . . . Sewage Disposal Equipment . . . Sluice Gates . . . Tanks . . . Tarmac Road Tars . . . Treated Timber . . . Waterproofing . . . Waterworks Gate Valves . . . Weed Killers . . . Gate Valves . . . Floor Stands . . . Bituminous Base Paints . . . Bronze Valve Stems

The Western Type A Gate Valve utilizes an assembly of yoke, wedge arms, and cone surfaces to provide a positive dual movement in opening and closing. Discs move *away* from seats, then out, in opening . . . reverse order of action in closing. Discs roll on tracks . . . valves can be installed in any position.

Western Sluice Gates are known for dependability of operation. Available with rising or non-rising stems; rectangular, square, or circular openings, or a combination of either, and in a complete range of sizes. Special gates manufactured to order.

To permit the rendering of maximum service to the waterworks field, Western offers a line of steel pipe, either welded or riveted. Standard fittings in a range of sizes are also available. Western quality standards are rigidly maintained.

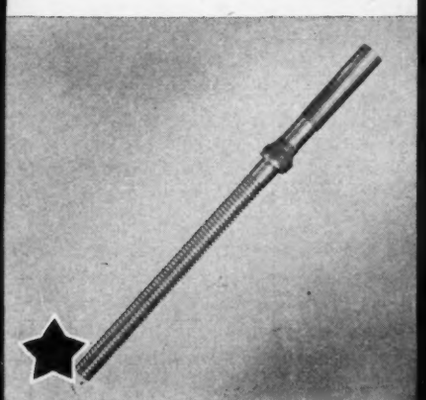
The complete line of Western Floor Stands provides a type for every need: rising or non-rising stem . . . plain or ball bearing . . . motor, hand wheel or crank; with or without indicator . . . this shows one of the models available.



Decades of experience in the manufacture of welded and riveted plate work gives these Koppers products something above the ordinary in quality and capacity for service. Old customers realize this—and new customers will appreciate it.

Koppers LUMINO bituminous-base paint bonds with metal or concrete, establishes a corrosion-defying protective coat. The aluminum forms an interleafed outer metallic surface. One coat thus does a double job.

Koppers Coal Tar Pitch Waterproofing is adding to the life of hundreds of concrete and masonry structures . . . piers, foundations, retaining walls, etc. Send for a copy of waterproofing specifications.



"Bronze Stem Forging Insurance." Koppers D.H.S. Bronze for valve stems exceeds other non-ferrous alloys in compressive strength, and yet is able to withstand shocks, wear, and heavy loads. Manufactured and processed by the Bartlett Hayward Division, Baltimore.

Koppers Divisions, Subsidiaries and Affiliates Serving the Water Works and Sewerage Fields

BARTLETT HAYWARD DIVISION — BALTIMORE, MD.
TAR AND CHEMICAL DIVISION — PITTSBURGH, PA.
WESTERN GAS DIVISION — FORT WAYNE, IND.
AMERICAN HAMMERED PISTON RING DIVISION — BALTIMORE, MD.
THE KOPPERS COAL COMPANY — PITTSBURGH, PA.
NEW ENGLAND COAL & COKE COMPANY — BOSTON, MASS.
THE WOOD PRESERVING CORPORATION — PITTSBURGH, PA.
NATIONAL LUMBER & CREOSOTING COMPANY — TEXARKANA, ARK.
THE WHITE TAR COMPANY OF NEW JERSEY, INC. — KEARNY, N. J.
THE MARYLAND DRYDOCK COMPANY — BALTIMORE, MD.

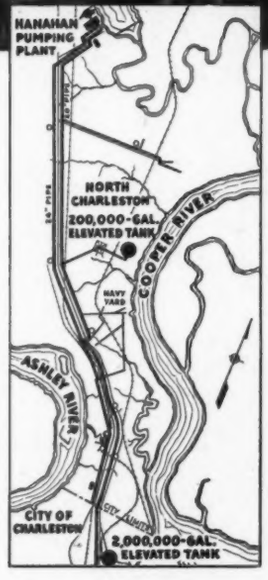
Charleston Again Chooses *Elevated Storage*

CHARLESTON, South Carolina, has long been familiar with the advantages of elevated water storage. The 2,000,000-gal. Horton tank erected there in 1926 was one of the first large tanks to be placed in service in that part of the country. Hence, it was only natural that the Charleston Water Department should again turn to elevated storage when they were recently given the job of managing the water distribution system in the Village of North Charleston.

As shown on the accompanying map, North Charleston is located near the transmission mains that bring water into Charleston proper. This made it simple to tap into one of the main lines with an 8-inch line to supply the North Charleston distribution system. The trouble with this was that in recent years peak demands exceeded maximum flow through the 8-inch pipe and loss of pressure resulted. Besides the nuisance to domestic consumers, this made a bad fire hazard.

The problem was solved very nicely with the 200,000-gal. Horton radial-cone bottom tank shown here. It operates in the same hydraulic plane as the 2,000,000-gal. tank in Charleston and likewise helps to unify the system by adding to the supply during periods of maximum demand. The capacity of the 8-inch line is ample to permit the tank to fill up during off peak periods.

This is just one example of the many ways in which elevated storage is helping solve water supply system problems. For additional information, address our nearest office.



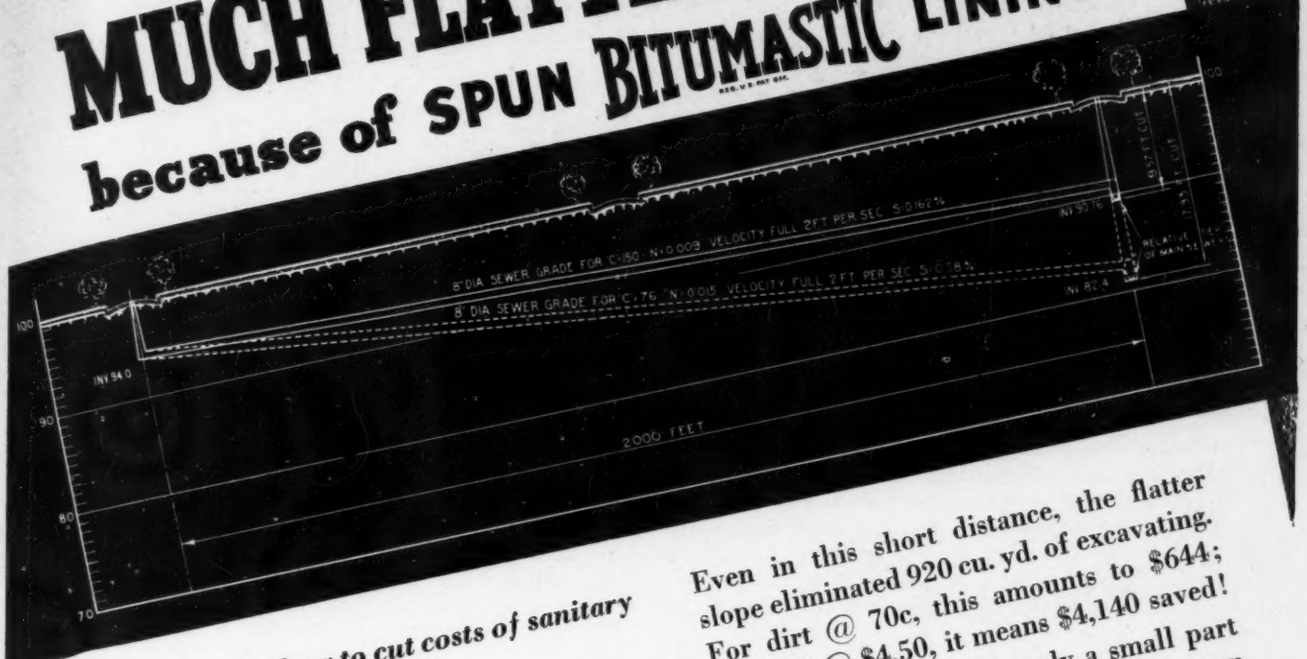
This new 200,000-gal. radial-cone bottom tank at North Charleston, S. C., is 91 ft. to bottom and has a range in head of only 17 ft. The map shows the location of lines bringing water to Charleston and North Charleston from the Hanahan Pumping Plant northwest of the cities.

CHICAGO BRIDGE & IRON COMPANY

Fabricating plants in CHICAGO, BIRMINGHAM, and GREENVILLE, PA.

Chicago.....2198 Old Colony Bldg.	Dallas.....1479 Liberty Bank Bldg.	Houston.....2919 Main St.	Boston.1548 Consolidated Gas Bldg.
New York.3390-165 Broadway Bldg.	Birmingham...1586 North 50th St.	Detroit.....1351 Lafayette Bldg.	San Francisco....1083 Rialto Bldg.
Cleveland...2262 Rockefeller Bldg.	Tulsa.....1646 Hunt Bldg.	Philadelphia..1644-1700 Walnut St.	Los Angeles...1455 Wm. Fox Bldg.

The same VELOCITIES MAINTAINED WITH MUCH FLATTER SLOPES because of SPUN BITUMASTIC LINING



HERE'S *how to cut costs of sanitary sewer pipe lines:*

1. USE METAL PIPE. You will get tight joints that stay tight, banishing infiltration . . . reducing the size of pipe you will need.

2. PUT A SPUN BITUMASTIC LINING IN THAT PIPE. You will start a chain of savings that begins with shallower slopes and ends with longer years of useful service from those sewer lines.

Take the installation illustrated above, for example. Though the sewer is only 2000 ft. long, putting a spun Bitumastic lining in the pipe cut the required slope almost in half—because the greatly reduced friction of the smooth Bitumastic surface (n = .009 lined, against the customary n = .015) offers so much less resistance to the flow.

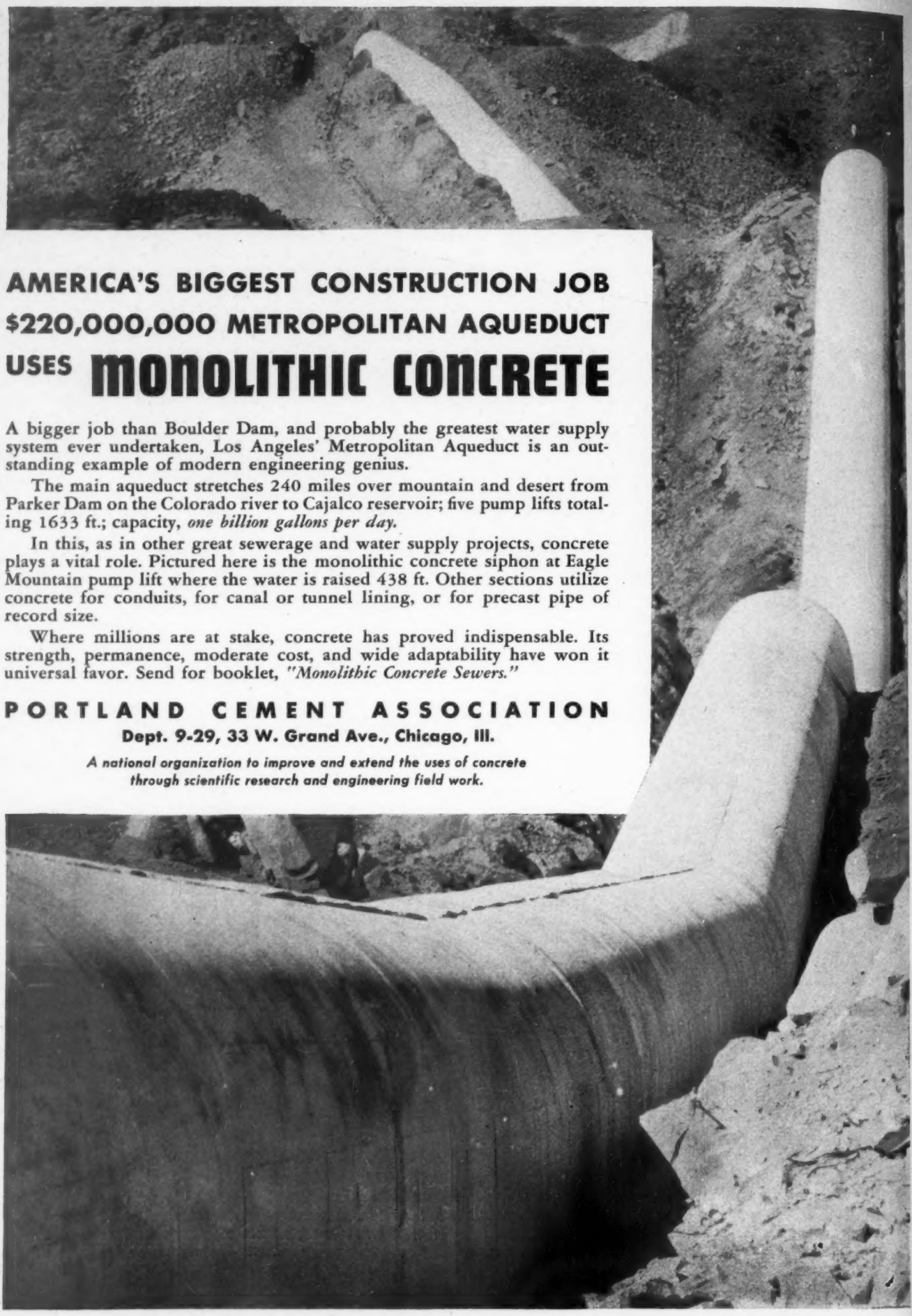
Even in this short distance, the flatter slope eliminated 920 cu. yd. of excavating. For dirt @ 70c, this amounts to $644; for rock @ $4.50, it means $4,140 saved! But saving on slopes is only a small part of the economies introduced by spun Bitumastic lining. Smaller pipe diameters, hence more footage in the budget; highest possible flow for years, making unnecessary the over-sizing of pipe; reduced power requirements for force mains; the selection and operation of pumps with maximum efficiency . . . no tuberculation . . . no corrosion . . . no reduction in capacity — all these make spun Bitumastic lining so economical that it often pays for itself in less than one year. Spun Bitumastic lining can be applied to sanitary sewer and water pipe 6" to 72" dia. or larger at pipe mill, foundry or on the job. Insist on genuine Bitumastic—the only coating material with a time-proved performance record.

WAILES DOVE-HERMISTON CORPORATION

[Also Manufacturers of INDUSTRIAL PAINTS for All Exterior and Interior Plant Surfaces]

BOSTON PHILADELPHIA CLEVELAND CHICAGO TULSA SAN FRANCISCO LOS ANGELES

17 BATTERY PLACE, NEW YORK, N. Y.



AMERICA'S BIGGEST CONSTRUCTION JOB
$220,000,000 METROPOLITAN AQUEDUCT
USES MONOLITHIC CONCRETE

A bigger job than Boulder Dam, and probably the greatest water supply system ever undertaken, Los Angeles' Metropolitan Aqueduct is an outstanding example of modern engineering genius.

The main aqueduct stretches 240 miles over mountain and desert from Parker Dam on the Colorado river to Cajalco reservoir; five pump lifts totaling 1633 ft.; capacity, *one billion gallons per day.*

In this, as in other great sewerage and water supply projects, concrete plays a vital role. Pictured here is the monolithic concrete siphon at Eagle Mountain pump lift where the water is raised 438 ft. Other sections utilize concrete for conduits, for canal or tunnel lining, or for precast pipe of record size.

Where millions are at stake, concrete has proved indispensable. Its strength, permanence, moderate cost, and wide adaptability have won it universal favor. Send for booklet, *"Monolithic Concrete Sewers."*

PORTLAND CEMENT ASSOCIATION

Dept. 9-29, 33 W. Grand Ave., Chicago, Ill.

A national organization to improve and extend the uses of concrete through scientific research and engineering field work.

"After 18 mo[illegible]tinuous op-[illegible] treated by the Nalco System, we opened a new Stirling type boiler and found the tubes and drums to be absolutely free from scale. Neither was there any sign of corrosion or deterioration."

This is typical of the reports received from users of the Nalco System of water treatment. Nalco treatment holds incrusting solids in suspension so that they do not settle on the tubes and form scale. The number of boiler washing and tube replacements is greatly decreased and drilling of scale is eliminated.

CLEAN BOILERS *lower* **fuel consumption**

NATIONAL ALUMINATE CORP.
PAIGE-JONES CHEMICAL CO.
6216 West 66th Place • Chicago, Ill.

A Nalco survey may reveal that definite savings can be made in your plant. Ask for it—no obligation.

NALCO SYSTEM

COLUMBIA

LIQUID CHLORINE

In Single and Multiple Unit
Tank Cars,

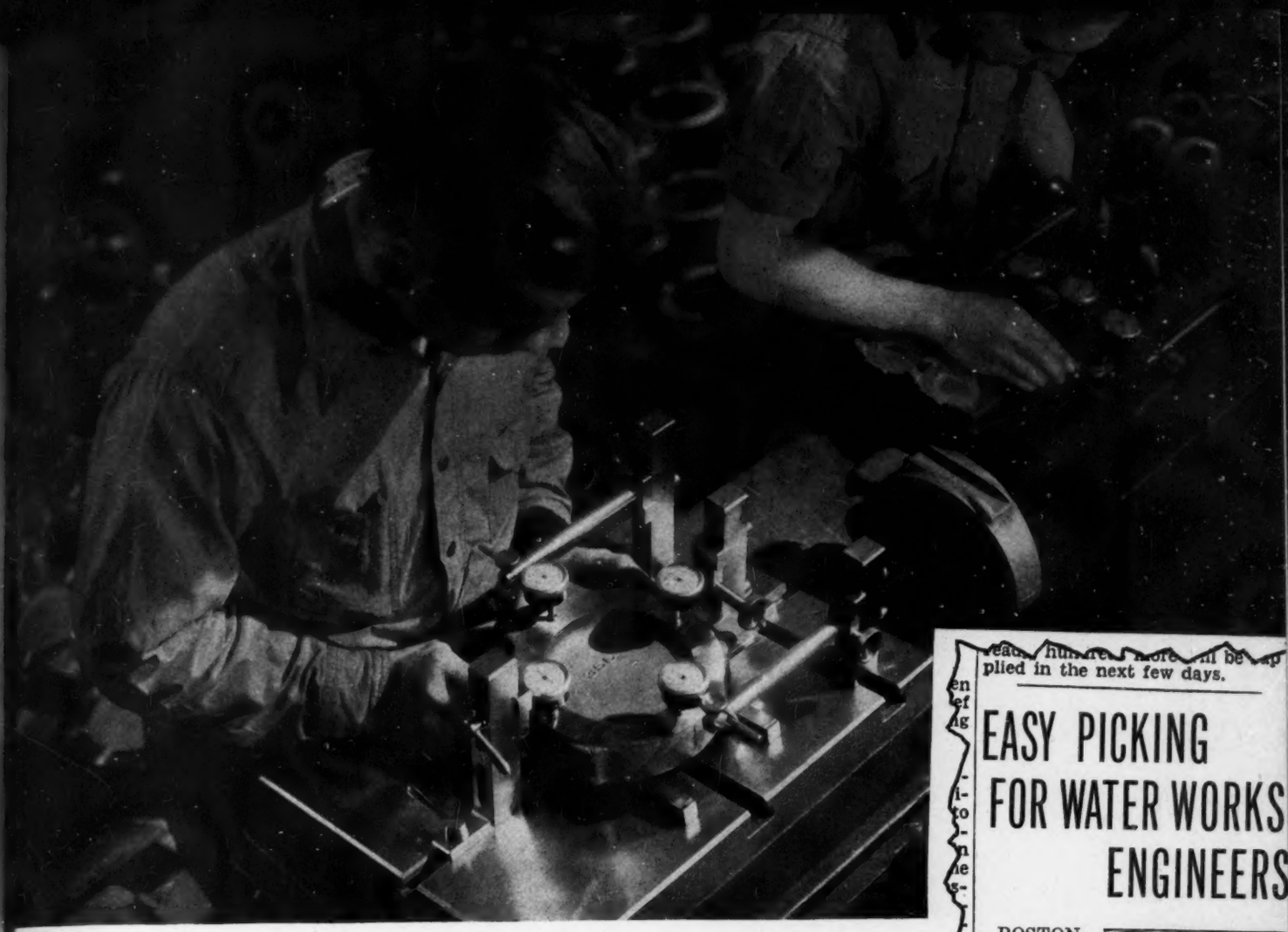
Also 100 and 150 lb. Cylinders

TRADE MARK REG.

THE COLUMBIA ALKALI CORPORATION

BARBERTON • OHIO

NEW YORK BOSTON MINNEAPOLIS
CHICAGO CLEVELAND CINCINNATI
ST LOUIS PITTSBURGH



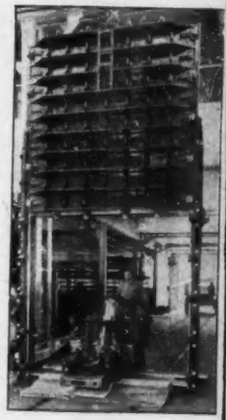
33,000 Unblinking Eyes

OVER 33,000 unblinking eyes in the huge Crane factory are on guard to make certain that Crane products are exactly right. They never wink at the smallest imperfection. They are the gauges, 33,000 of them, used to check the accuracy of Crane manufacturing.

Consider the illustration above. Micrometer gauges are shown measuring the taper of gate valve discs to an accuracy allowing for no variations. Or take pipe threads. When the standards for American Pipe Threads were established, Crane ordered a set of master gauges which required two years of continuous work to finish. These were checked by the Bureau of Standards at Washington, D. C. This approved set of gauges is only used from time to time to insure the accuracy of Crane master gauges with which reference gauges are regularly compared. They, in turn, are used for checking working gauges. All of this is done just to make certain that the threads on Crane products are as nearly perfect as is possible.

This is one example of the many elaborate methods used by Crane to make certain that every Crane product which you buy is the finest of its kind in every way. Look in your new Crane No. 52 Catalog for the details of 38,000 items tested in the laboratory and on the job. CranEquip for satisfaction.

EASY PICKING FOR WATER WORKS ENGINEERS



BOSTON, MASS., Aug. 16—Engineers in charge of water works, sewage disposal plants, or filtration plants find it easy to pick the valves they need from the pages of their Crane No. 52 Catalog.

On page 102 is information about the Crane A.W.W.A. water works iron body gate valves. Following that are many pages devoted to low-pressure and high-pressure valves. Elsewhere in the volume are approximately 38,000 other items among which city engineers can find practically anything they need in piping equipment. Crane sluice gates and operating mechanisms are described on pages 119-125, inclusive, for example.

Unify ordering, service and responsibility for easier, more economical handling by CranEquipping your water and sewerage systems. Let's talk it over at the Crane Exhibit at the New England Water Works Association Convention, Poland Springs, Maine, September 21 to 24.

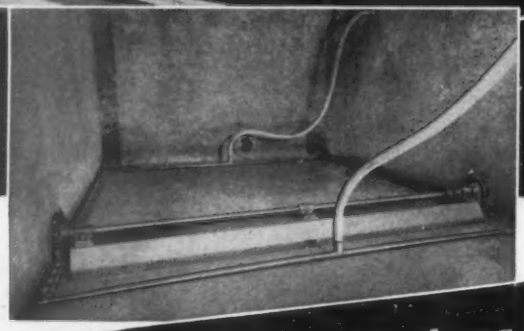
CRANE

CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVENUE, CHICAGO, ILL.

Branches and Sales Offices in One Hundred and Sixty Cities

VALVES, FITTINGS, FABRICATED PIPE, PUMPS, PLUMBING AND HEATING MATERIAL

THE REX TOW-BRO SHOWS HOW TO HANDLE IT IF *IT* IS REMOVING FLOCCULENT SOLIDS



In Sewage, Trade Wastes and Water Treatment Plants the Country Over

Rex Tow-Bro Installations

Sewage Plants

1. Barrington, Ill.—Consoer, Townsend & Quinlan, Milwaukee, Wis. — 1 Tank
2. Burlington, Wis.—Robert Cramer & Sons, Milwaukee, Wis. — 1 Tank
3. Escanaba, Mich.—Suhr, Berryman, Peterson & Suhr, Chicago, Ill. — 1 Tank
4. Madison, Wis.—Greeley & Hansen, Chicago, Ill. — 2 Tanks
5. Milwaukee, Wis.—Sewerage Commission, City of Milwaukee — 10 Tanks
6. Platteville, Wis.—Jerry Donohue Engr. Co., Sheboygan, Wis. — 1 Tank
7. Rochelle, Ill.—Suhr, Berryman, Peterson & Suhr, Chicago, Ill. — 1 Tank
8. State Hospital—Kings Park, N. Y.—State Dept. of Public Works, Albany, N. Y. — 2 Tanks
9. Topeka, Kansas—Charles Haskins, Kansas City, Mo. — 2 Tanks
10. Whitehall, Mich.—Consoer, Townsend & Quinlan, Milwaukee, Wis. — 1 Tank

Water Treatment Plants

1. Fairmont, Minn.— Mr. Guy Basson, Supt. Water Dept. — 2 Tanks
2. Mt. Sterling, Ohio—Burgess & Niple, Columbus, Ohio — 1 Tank
3. New Iberia, La.—Gulf Public Service Co., New Iberia, La. — 1 Tank

Trade Wastes Handling

1. Combined Locks, Wis.—Combined Locks Paper Company — 2 Tanks
2. Wisconsin Rapids, Wis.—Consolidated Water Power & Paper Co. — 1 Tank

Rex Tow-Bro units have been installed extensively in both new and existing round tanks — also in rectangular tanks. They are giving greater sludge settling and removing capacity—greater flexibility and efficiency in operation.

Designed and built especially for the removal of activated sludge and for operation in any settling tank handling flocculent solids or solids sensitive to disturbance during concentration and removal, the Rex Two-Bro has, from every standpoint, proved to be the best sludge removal equipment available.

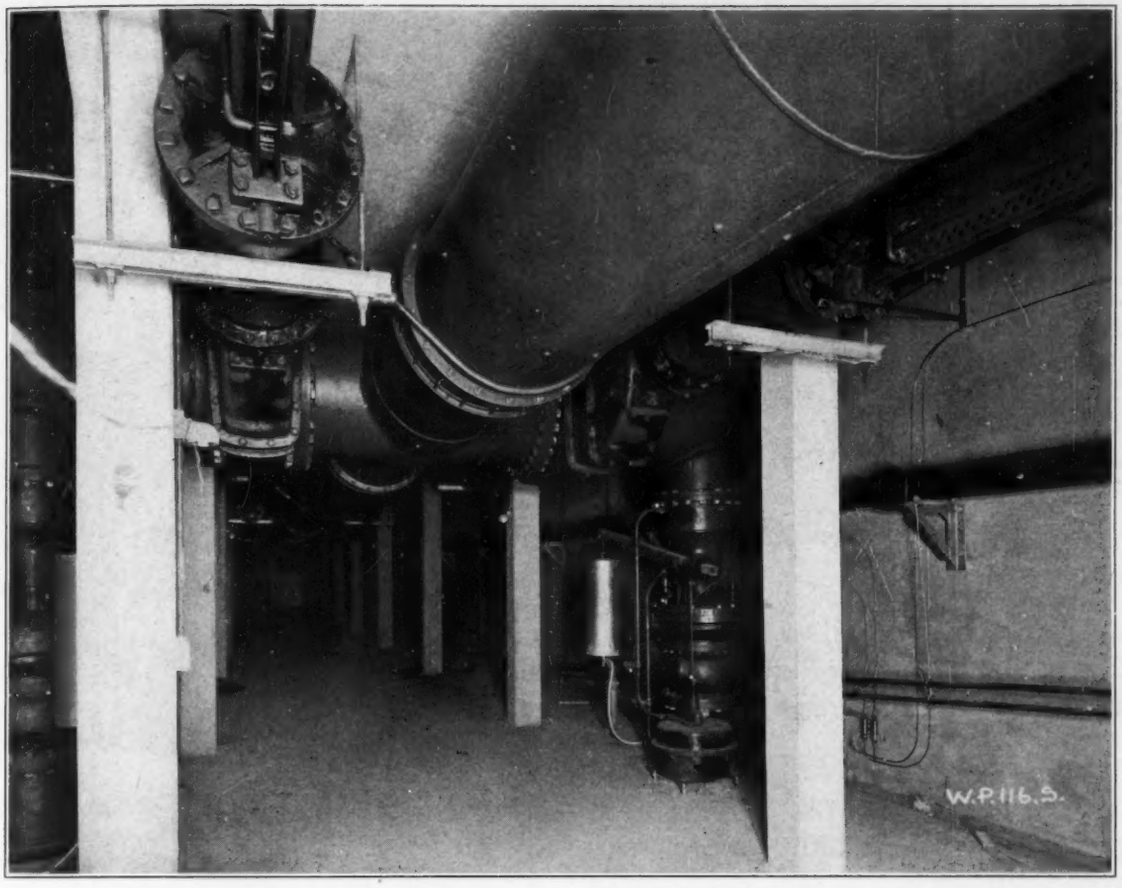
Get Bulletin No. 279 for complete information on all sizes and types of installations. Address the Chain Belt Company, 1610 W. Bruce Street, Milwaukee, Wisconsin.

REX

CHAIN BELT COMPANY of MILWAUKEE

Sanitation Equipment

TODAY'S FILTER PLANT



Pipe Gallery, Milwaukee Filter Plant, showing SIMPLEX Vertical Rate Controllers and Piezometers for Air-Driven Gauges.

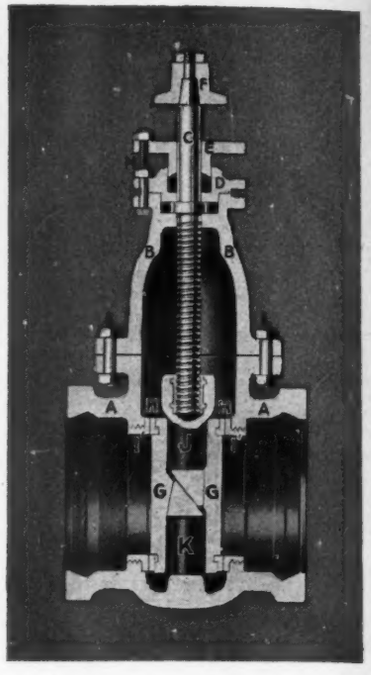
SIMPLEX

- **Venturi Type Meters**
- **Rate Controllers for vertical installation**
- **Air-Driven Filter Gauges with Summation Indicator showing Total Discharge of All Filters**
- **Sand Expansion Indicators**
- **Pump Casing Tap Meters**

Write for Data

SIMPLEX VALVE & METER CO.
6743 UPLAND STREET • PHILADELPHIA, PA.

EVERY KIND of WATER WORKS VALVE



This cutaway illustrates the basic design of every Ludlow valve. Note the sturdy construction — absence of complicated working parts.

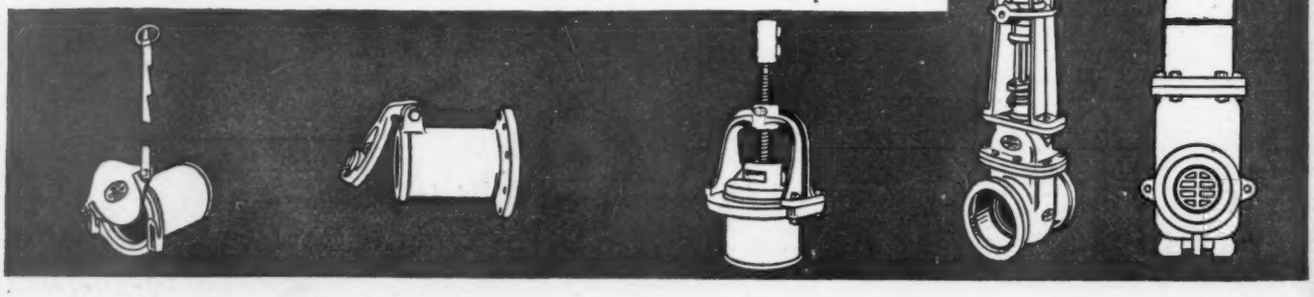
Whether you want a small supply line valve or a huge gate for a 72" main, Ludlow will supply it. The same applies to the various types of sewerage equipment.

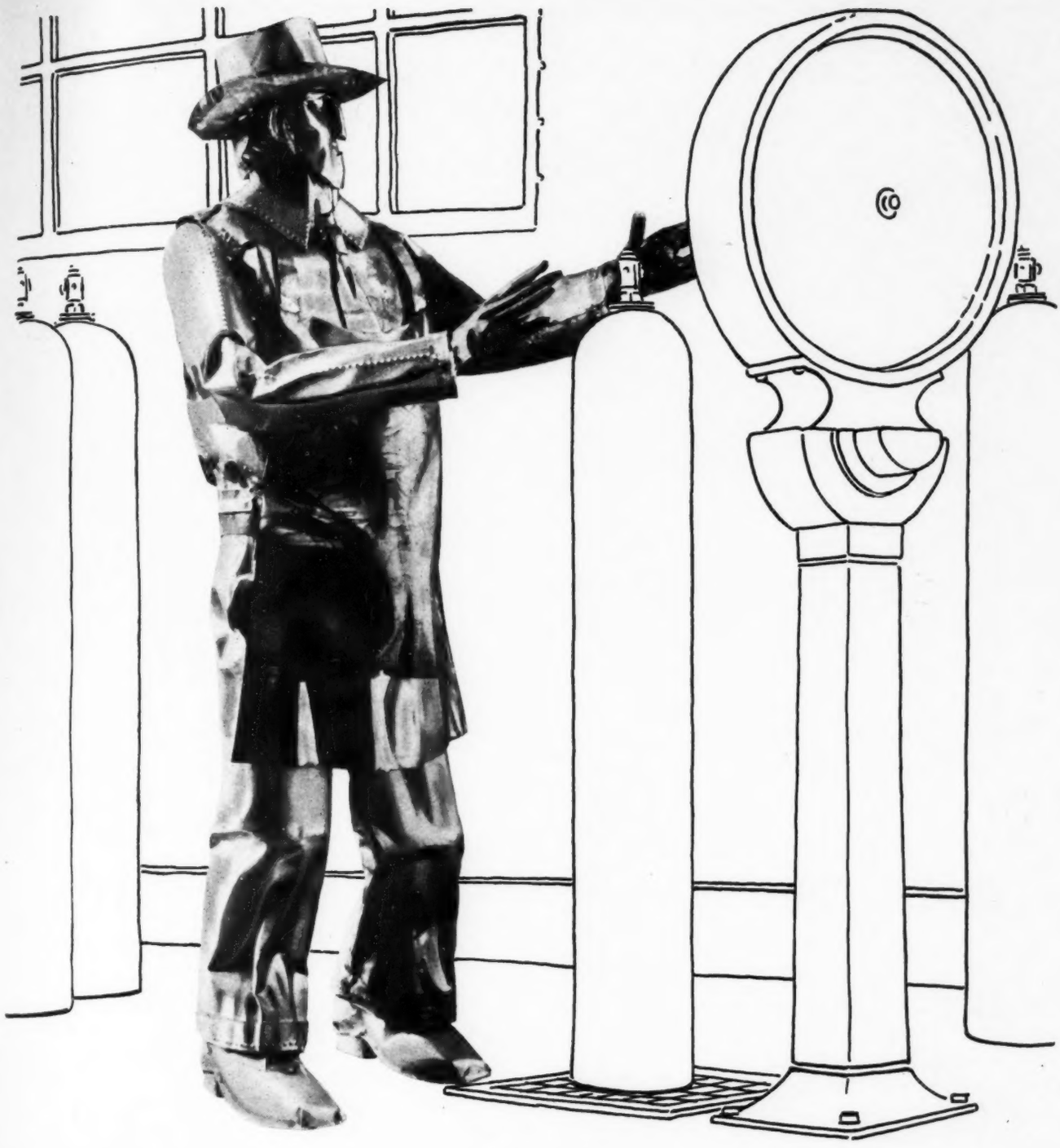
To build a complete line, every item of Ludlow reliability is our aim. The huge Ludlow plant and the continuing patronage of water works engineers everywhere is proof that Ludlow is living up to that aim.

Whatever your valve needs—get a quotation from Ludlow.

All Ludlow water works valves conform rigidly to A. W. W. A. specifications.

THE LUDLOW VALVE MFG. CO.
TROY, N. Y.





EBG MAKES A CLEAN GETAWAY . . . WEIGHT RE-CHECKED BY INSPECTOR. *After an EBG container is filled it is re-checked on a separate scale to guard against over-filling. It is a fixed rule that twenty-four hours must elapse between filling and shipping. This observation period is just one of the many precautions we take against shipping a defective container or valve. Such care and precision are typical of every step in EBG production — our guarantee that EBG Liquid Chlorine is pure and uniform and that it makes a "clean getaway" from our plant to yours.*

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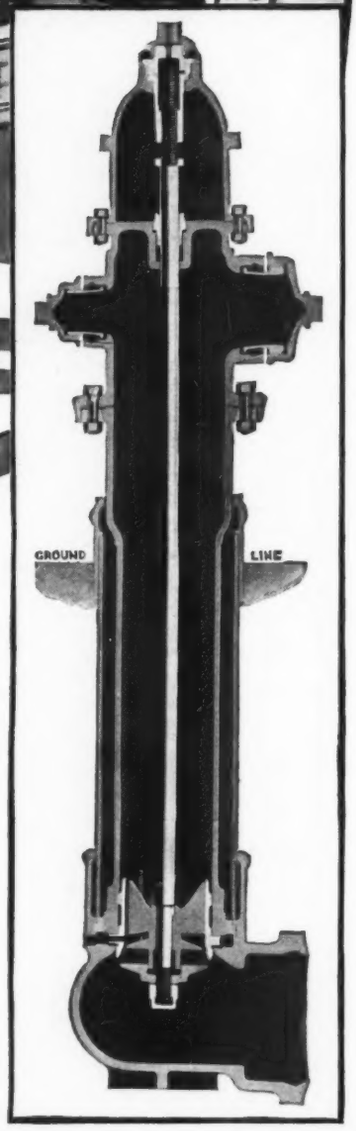
ELECTRO BLEACHING GAS COMPANY
Main Office: 60 East 42nd Street, New York, N. Y.
Plant: Niagara Falls, N. Y.

EBG Liquid Chlorine
FIRST IN THE COUNTRY

"THOSE TWO MEN HAVE OVERHAULED ALL OUR OLD

MATHEWS HYDRANTS

IN SPARE TIME"



The inside of the elbow is threaded. The entire barrel including all working parts can be lifted out for inspection, overhaul, or accident-repair, without digging.

"This spring we wanted an appropriation to overhaul some 50-year-old hydrants. It turned out we only needed to replace some packing, a few valve-leathers and a few worn operating nuts. For we have Mathews Hydrants.

"Those two men go out to a hydrant, unscrew the barrel, lift it out and put in our spare. Then they take the old one back to the shop, check it all over, repack and lubricate it in spare time, and use it to replace another. They've about covered the town now, they've had every hydrant in the shop, they haven't dug a shovelful of dirt, and we didn't need an appropriation."

SPECIFY MATHEWS

You'll save money for the next 75 years.

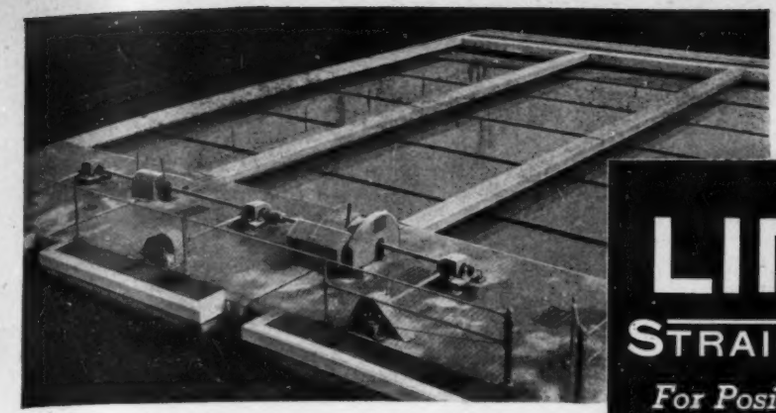
Mathews Hydrants

BUILT FOR EMERGENCIES

R. D. WOOD CO.

400 Chestnut St., Philadelphia, Pa.

manufacturers of SAND-SPUN PIPE which is centrifugally cast in sand molds, and R. D. Wood heavy-duty gate valves for water works.



Link-Belt STRAIGHTLINE Collectors. High efficiency, long life, low maintenance and positive removal of sludge make the STRAIGHTLINE Collector the preferred unit for removing sludge from settling tanks. This installation is at Janesville, Wis. Joseph Lustig, City Engineer.

LINK-BELT

STRAIGHTLINE EQUIPMENT

For Positive Results and High Efficiency

•

SCUM BREAKERS FOR DIGESTION TANKS
(Round or Rectangular)

•

BAR SCREENS

•

GRIT CHAMBER EQUIPMENT

•

SLUDGE COLLECTORS
(For primary and final rectangular tanks)

•

CIRCULINE COLLECTORS
(For center-feed round tanks)

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(ROTARY AND AIR)

•

FINE SCREENS

•

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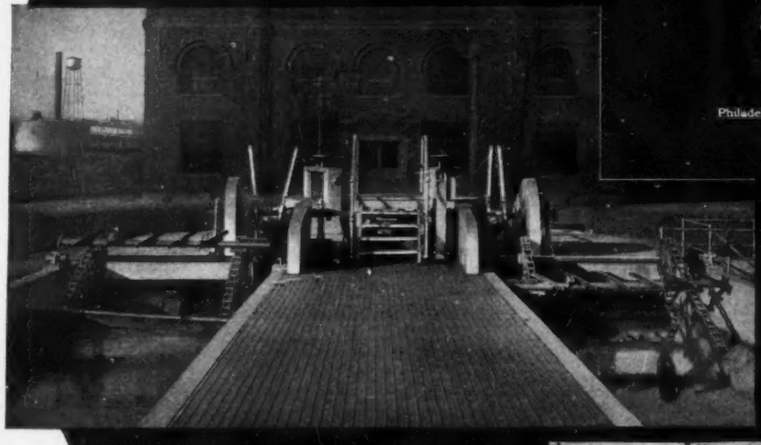

Link-Belt C
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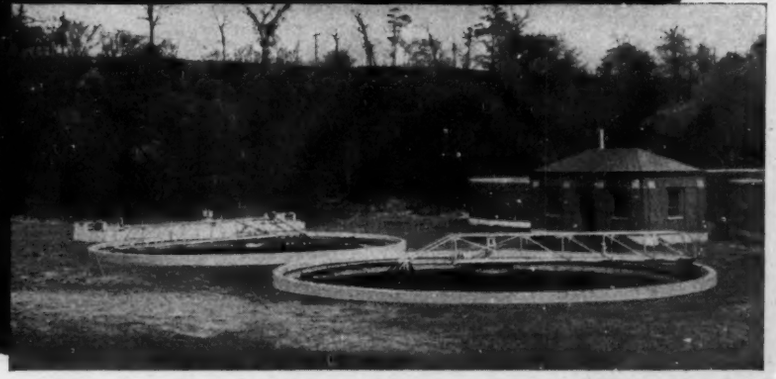
added advantage
for large tanks. Th
Greeley & Hansen, Co



CITIES,...
MAKE A CHEAP COMPOST
for your
Municipal Parks & Gardens

Machines made in four sizes—either belt, gasoline engine or electric drive—now equipped with pneumatic tires. Prices advanced slightly as of July 15.

USING THE
ROYER DISINTEGRATOR

A Royer Disintegrator Will Pay for Itself

The Royer Sludge Disintegrator will rapidly and economically shred sludge containing from 30 to 60 per cent moisture into fine particles at a cost of thirty cents or less per cubic yard. The smallest size disintegrator will shred 2 cubic yards per hour using a ¾ H. P. motor. Operating costs are therefore very low, as also are maintenance and repair costs.

In many instances the cheap supply of compost for municipal parks, lawns and gardens will soon pay for the disintegrator.

In the past the organic matter for lawns, parks and gardens was derived largely from animal manure, but in recent years this source of supply has practically disappeared. It is as a substitute for this material that sewage sludge should be utilized. It should not be wasted.

Let us send you details of the machine and interesting information on the value of Disintegrated sludge as a fertilizing compost.

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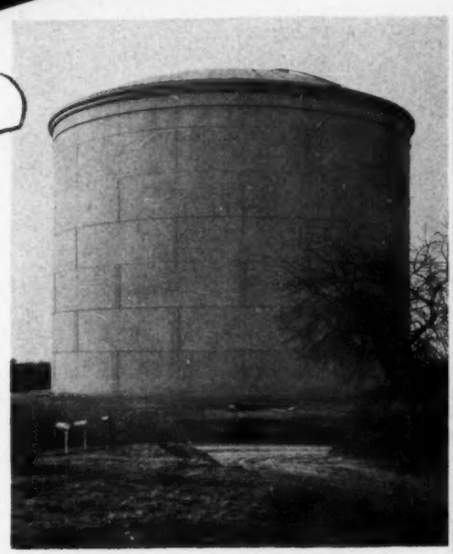
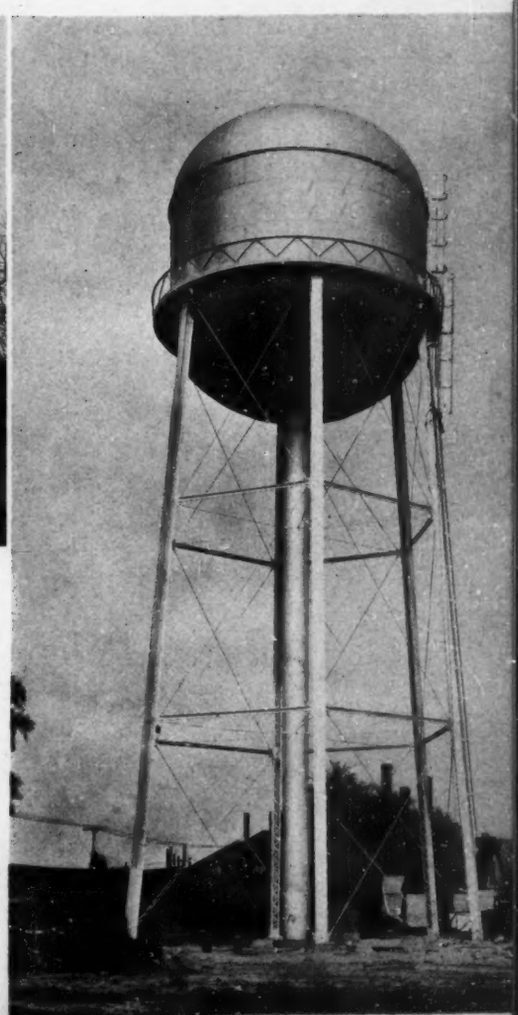
P·DM BUILT TANKS *have a* MASTER'S DEGREE *in the waterworks field!*





P·DM's long years of experience in solving the Elevated Tank problems of municipal and private water systems result in this fact: that when P·DM builds your tank, you may rest assured of perfection in every detail of design, workmanship and performance.

Planned, fabricated and erected by one responsible organization, Pittsburgh-Des Moines Elevated Tanks bear a reputation secured by the faithful functioning of *every* P·DM Tank built since the company entered the field in 1893.

Pittsburgh-Des Moines offers the cooperation of its engineers in the preliminary studies entailed by your contemplated installation, and will gladly furnish complete construction estimates. A letter addressed to our nearest office will bring any desired information—at no obligation whatever.

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GETS DEPENDABLE SERVICE *FROM MATHIESON CHLORINE FOR 7 YEARS*

"In reply to your inquiry regarding our use of your products, we are glad to advise that we have been using Mathieson Chlorine in our filtration plant for the past seven years.

"In that time we have found your company to be a dependable source from the standpoint of service and the condition of cylinders on arrival. Our satisfaction is therefore complete.

"Starting this summer, we are going to operate a municipal swimming pool and we will be users of HTH in addition to chlorine."

(Signed) **E. F. EDGE**
Superintendent of Public Works

EVER since the pioneer days of shipping liquid chlorine, dependability has been the keynote of Mathieson's service to chlorine users. No effort is spared in supplying a pure product, in trouble-free container equipment, delivered to you at the time specified. That is why men like Mr. Edge, upon whom rests the responsibility of insuring a safe water supply for their communities, continue to contract for Mathieson Liquid Chlorine year after year.

The* MATHIESON ALKALI WORKS *(Inc.)
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Soda Ash . . . Liquid Chlorine . . . Bicarbonate of Soda . . . HTH and HTH-15 . . . Caustic Soda . . . Bleaching Powder . . . Ammonia, Anhydrous and Aqua . . . PH-Plus (Fused Alkali) . . . Solid Carbon Dioxide.

View of filtration Plant at Shawnee and (above) E. F. Edge, Superintendent of Public Works, City of Shawnee, Oklahoma.

Problem:

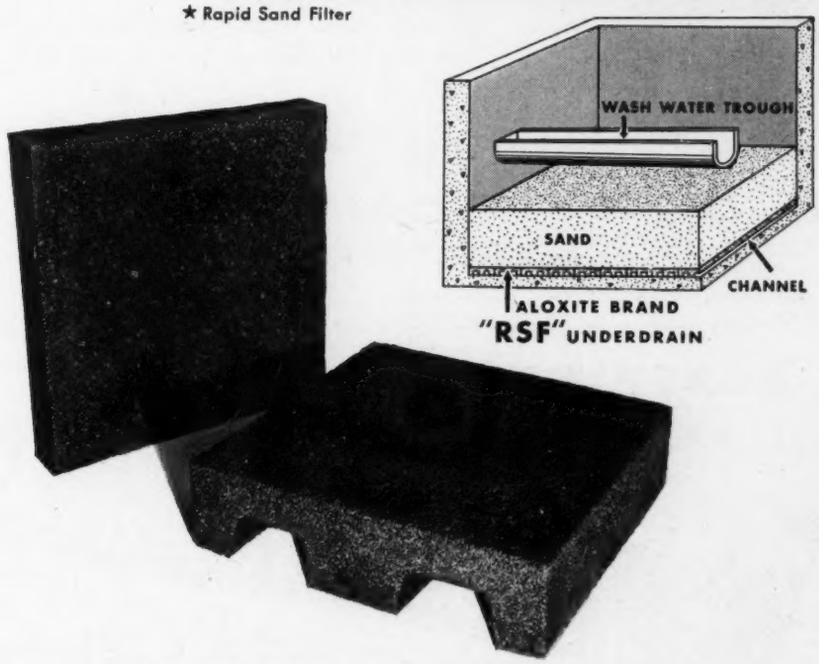
IMPROVEMENT OR REHABILITATION OF OLD FILTERS?

Solution:

THE ALOXITE BRAND RSF* POROUS UNDERDRAIN SYSTEM

REG. U. S. PAT. OFF.

★ Rapid Sand Filter



- *Do you have a proper depth of sand?*
- *Have you sufficient positive head for filtration to prevent air binding?*
- *Is there enough distance between top of sand and wash gutter to permit proper rate of wash?*

THESE common problems of early built filters—often quite shallow—are solved through installation of the Aloxite Brand RSF★ Porous Underdrain System. At least 12″ and up to 18″ is gained through elimination of the graded gravel layers.

Other problems of corrosion, loss of sand, non-uniformity of back wash etc., are also solved by this new but proved system—now functioning in 10 plants throughout the country.

Let us discuss your problem with you—write for further details.

THE CARBORUNDUM COMPANY • NIAGARA FALLS, N.Y.

Sales Offices and Warehouses in New York, Chicago, Boston, Philadelphia, Cleveland, Detroit, Cincinnati, Pittsburgh, Grand Rapids

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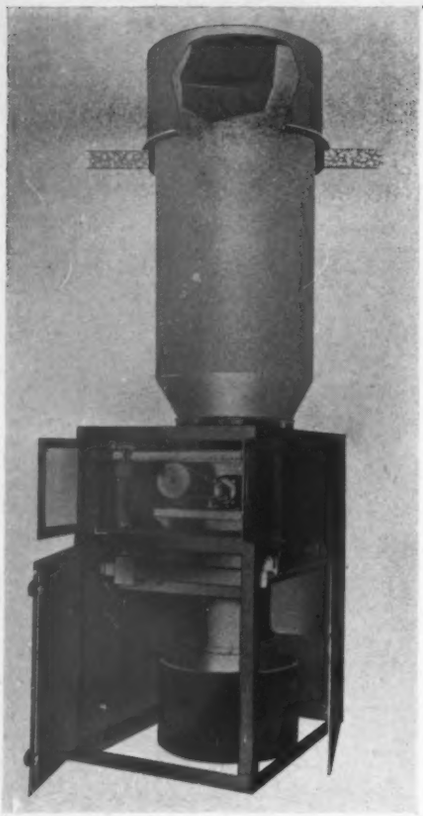


Omega Universal Feeder, size 2, mounted in a cabinet with Omega built-in hopper scales and standard mixing chamber. Maximum capacity 2,000 lbs. Floor space 36"x48".

OMEGA-THE LAST WORD!

Omega Has Always Pioneered in Metering and Feeding Equipment. A Few Examples Are Given Below:

Feeders mounted on scales so that the delivery for any time period may be accurately determined. See illustration.

Dust removal equipment for preventing dust incident to filling hoppers. Applicable to all sizes and types of Omega Feeders.

High temperature Lime Slakers, with thermostatic control —The most efficient Slakers on the market.

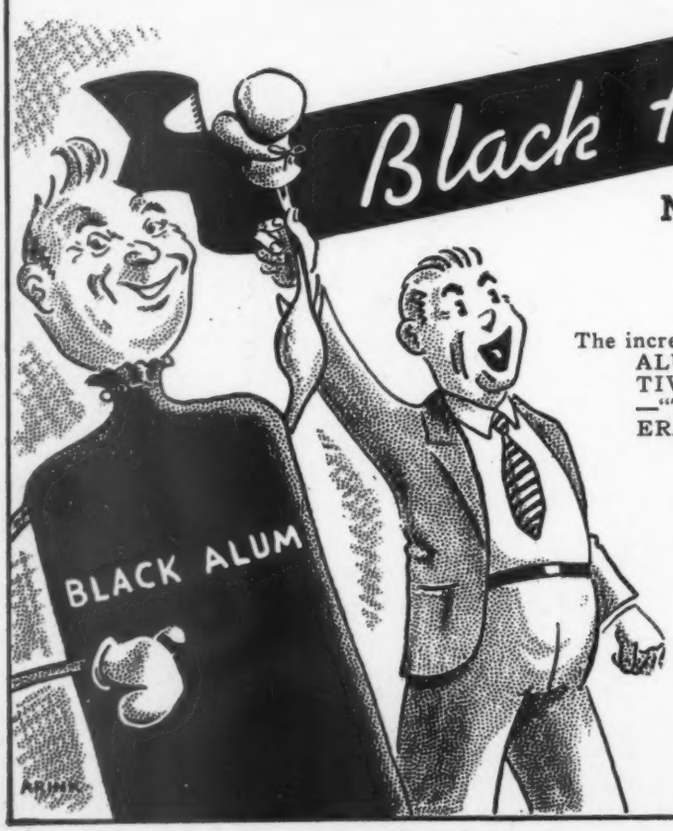
Last, but not least—Gravimetric Feeders for both dry and liquid materials, feeding by weight and not by volume.

Consult Omega on Metering and Feeding Problems.

OMEGA MACHINE COMPANY

4010 PENN AVE. **KANSAS CITY, MO.**

38 SUPERINTENDENTS SAY:



Black Alum Wins!

NOW USED in 38 PLANTS IN 14 STATES

The increasing number of Superintendents switching to BLACK ALUM COAGULATION is recorded above—because ACTIVATED ALUM CORPORATION is proud of this fact —"THAT IN DOLLARS AND CENTS IN PLANT OPERATION BLACK ALUM PRODUCES THE BEST WATER"—

Did you know that the new BLACK ALUM costs no more than the regular alum you are now using—

Did you know that ACTIVATED ALUM CORPORATION also manufactures—

STANDARD BRAND ALUM
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WATER WORKS & SEWERAGE

E. S. GILLETTE, Publisher

L. H. ENSLOW, Editor

ARTICLES AND AUTHORS Scheduled for Future Issues

In our issue of November, 1936, the unique **Industrial Water Supply Project of Birmingham, Alabama,** was described by A. Clinton Decker, a member of Birmingham's Engineering Commission for Industrial Water Supply. In the next issue, Mr. Decker's second article on this novel project of many unusual features will appear. The follow-up article reveals experiences in construction, special problems encountered and methods of solution; also methods of making acceptance tests on the 23 mile long supply line of 42 to 60 inch coated and lined steel pipe of ⅜ inch wall thickness, in 48 ft. lengths, jointed with friction type flexible couplings.

"The Tank Filter"—A contribution from Dr. H. Bach, well known Chemist of Berlin, Germany, who conceived and with Dr. Karl Imhoff developed the inexpensive "Tauch-Korpfer" method of treating sewage. Dr. Bach's article will prove extremely timely at this stage of high interest in treatment methods involving the precipitation of non-settleable portions of wastes or sewage by bioflocculation, alone or aided by chemicals. Dr. Bach reviews the principles and basic requirements involved; presents plant operating experiences and results; cites and picturizes representative, and long-going, installation of air-fed "Tank Filters," treating industrial and domestic sewages dependably and economically.

"The Fully Automatic Softening Plant of Cuyahoga Falls, Ohio," recently completed, is to be described in our next issue by Rollin F. MacDowell, Consulting Engineer of Cleveland and H. L. Beohner, Chemical Engineer of the Permutit Company. Interesting to many will be the number of unique features of this self-operating dual purpose water treatment plant. Likewise, will be the method of arriving at the decision to construct for Cuyahoga Falls what is believed to be the largest fully automatic combination iron removal and zeolitic softening plant for any municipality. The plant, designed for eventual treatment of 4,000,000 gals. per day, is equipped with filters and zeolite beds to deliver 75 per cent of its ultimate capacity.

"Betterments to the El Paso, Texas Sewage Treatment Works," are to be described by Chas. D. Yaffe, Plant Superintendent and Chemist. Of especial interest are the results secured since revamping of the plant under direction of Black and Veatch Engineers. In the new scheme, chemical precipitation with separate sludge digestion, has been effective in producing an effluent of desired quality to meet seasonal stream loading requirements. Of considerable interest are the El Paso experiences in production and control of ferrous and ferric chloride generation from scrap metal and chlorine in up-flow contact towers. The method of overcoming inherent difficulties to effect an increased efficiency in production of ferric chloride, and control of dosages, is of particular interest. Likewise is the efficacy of the iron treatment in reducing oxygen demands, and cost data.

"Sewer Construction With Concrete Segments"—Is the second of the promised series of articles from the eminent British Consultant, John D. Watson. This article reveals experiences in building large diameter sewers with precast segments of reinforced concrete. Simplicity of fabrication, and construction and low costs are effects of primary interest.

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How many have original Cast Iron Mains in Service?

Look at this list of 212 cities. There are 204 with solid black symbols indicating original cast iron water mains in service.* Note the 10 stars signifying cast iron pipe in service for a century or more. Only a material with great *bursting* strength, *beam* strength, *crushing* strength, *impact* strength, and effective resistance to corrosion—indispensable requirements of an underground main—can render such enduring and economical service.

THE ANSWER IS

96%

SYMBOLS: ○ *In service 100 years or more* □ *50 to 99 years* ○ *under 50 years*

SOLID SYMBOLS INDICATE ORIGINAL PIPE IN SERVICE

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- □ Birmingham
- ■ Mobile
- ■ Tuscaloosa

ARKANSAS
- ■ Fort Smith
- ■ Little Rock

CALIFORNIA
- ● Alhambra
- ● Fresno
- ● Long Beach
- ■ Oakland
- ■ Pasadena
- ■ San Diego
- ■ Los Angeles
- ■ Sacramento
- ■ San Francisco
- ■ Stockton

COLORADO
- ■ Denver
- ● Fort Collins
- ■ Pueblo

CONNECTICUT
- ■ Hartford
- ■ New London
- ■ Stamford

DELAWARE
- □ Wilmington

DISTRICT OF COLUMBIA
- ■ Washington

FLORIDA
- ■ Jacksonville
- ■ Orlando
- ● St. Augustine
- ● West Palm Beach

GEORGIA
- ■ Atlanta
- ■ Augusta
- ● Decatur
- ■ Macon

IDAHO
- ● Boise
- ● Pocatello

ILLINOIS
- ● Berwyn
- ■ Bloomington
- ■ Chicago
- ■ Elgin
- ■ Evanston
- ■ Galesburg
- ■ Moline
- ■ Oak Park
- ■ Peoria
- ■ Quincy
- ■ Rockford

INDIANA
- ■ Elkhart
- ■ Evansville
- ■ Fort Wayne
- ● Gary
- ■ Indianapolis
- ■ La Fayette
- ■ Michigan City
- ■ Richmond
- ■ Terre Haute

IOWA
- ■ Burlington
- ■ Davenport
- ■ Des Moines
- ■ Dubuque
- ■ Ottumwa

KANSAS
- ■ Hutchinson
- ■ Topeka

KENTUCKY
- ■ Covington
- ■ Louisville
- ■ Paducah

LOUISIANNA
- ● New Orleans
- ■ Shreveport

MAINE
- ■ Bangor
- ■ Portland

MARYLAND
- ★ Baltimore
- ■ Hagerstown

MASSACHUSETTS
- ■ Boston
- □ Brockton
- ■ Cambridge
- ■ Chelsea
- □ Fall River
- ■ Fitchburg
- ■ Holyoke
- ■ Lowell
- ● Malden
- ■ New Bedford
- ■ Newton
- ● Revere
- □ Somerville
- ■ Springfield
- ■ Taunton
- ■ Waltham
- ■ Worcester

MICHIGAN
- ■ Ann Harbor
- ■ Battle Creek
- ■ Bay City
- ● Dearborn
- ■ Detroit
- ■ Flint
- ■ Grand Rapids
- ● Hamtramck
- ● Highland Park
- □ Kalamazoo
- ■ Muskegon
- ■ Port Huron

MINNESOTA
- ■ Duluth
- ■ Minneapolis
- ■ St. Paul

MISSISSIPPI
- ● Jackson
- ■ Vicksburg

MISSOURI
- ★ St. Louis
- ■ Kansas City
- ■ Springfield

MONTANA
- ● Billings
- ● Great Falls
- ● Missoula

NEBRASKA
- ■ Lincoln
- ■ Omaha

NEW HAMPSHIRE
- ● Berlin
- ■ Concord
- ■ Manchester
- ■ Nashua

NEW JERSEY
- ■ Atlantic City
- ● Elizabeth
- ■ Hoboken (Hackensack Water Co.)
- ■ Jersey City
- ■ Newark
- ■ New Brunswick
- ■ Paterson
- ● Plainfield

NEW YORK
- ■ Amsterdam
- ■ Binghamton
- ■ Elmira
- ■ Jamestown
- ■ Kingston
- ■ Mt. Vernon
- ■ New Rochelle
- ○ New York City
- ● Niagara Falls
- ■ Rochester
- ■ Syracuse
- ■ Utica
- ■ Yonkers

NEW MEXICO
- ● Roswell

NORTH CAROLINA
- ■ Asheville
- ■ Charlotte
- ■ Durham
- ● Greensboro
- ● High Point
- ● Raleigh
- ■ Wilmington

NORTH DAKOTA
- ■ Bismark
- ■ Fargo
- ■ Grand Falls

OHIO
- ■ Akron
- ■ Cincinnati
- ■ Cleveland
- ● Cleveland Hts.
- ■ Columbus
- ● East Cleveland
- ■ Hamilton
- ■ Lima
- ● Marian
- ■ Newark
- ■ Toledo
- ■ Warren
- ■ Youngstown

OKLAHOMA
- ● Ada
- ● Enid
- ● Oklahoma City

OREGON
- ● Eugene
- ■ Portland

PENNSYLVANIA
- ■ Erie
- ■ Jamestown
- ★ Lancaster
- ■ New Castle
- ★ Philadelphia
- □ Pittsburgh
- ★ Reading
- ● Wilkensburg
- ■ York

RHODE ISLAND
- ■ Cranston
- ■ Pawtucket
- ■ Providence
- ■ Woonsocket

SOUTH CAROLINA
- ■ Charleston
- ● Greenville
- ■ Spartanburg

TENNESSEE
- ■ Chattanooga
- ■ Knoxville
- ★ Nashville

TEXAS
- ■ Dallas
- ■ Fort Worth
- ● San Angelo
- ■ Texarkana

UTAH
- ■ Provo
- ■ Salt Lake City

VIRGINIA
- ★ Lynchburg
- ● Newport News
- ■ Norfolk
- ■ Petersburg
- ● Portsmouth
- ★ Richmond

WASHINGTON
- ● Bellingham
- ■ Seattle
- ■ Tacoma

WEST VIRGINIA
- ● Clarksburg
- ★ Wheeling

WISCONSIN
- ■ Eau Claire
- ■ Fond DuLac
- ■ Green Bay
- ● Kenosha
- ■ Madison
- ■ Milwaukee
- ■ Oshkosh
- ■ Racine
- ● Sheboygan
- ● Superior
- ● West Allis

*In a few instances gas mains are referred to where they are older than water mains.

THE CAST IRON PIPE RESEARCH ASSOCIATION
Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Bldg., Chicago

WATER WORKS AND SEWERAGE
A GILLETTE PUBLICATION
VOL. 84 SEPTEMBER, 1937 No. 9

SOFTENING PLANT IMPROVEMENTS AT TOPEKA

By DANIEL H. RUPP
Production Engineer, Water Department, Topeka, Kansas

The Author

THE major source of water supply for Topeka is the Kaw River. The pollution burden is moderately high—running to 32,000 b. coli per 100 cc.; the monthly average is 5,000. However, 98 per cent of this is normally removed in the softening process, and chlorination always reduces the coli index to well below the U.S.P.H.S. standard of 1 per 100 cc. A supplementary supply is drawn from wells.

Being a very flashy stream, producing turbidities up to 25,000 with monthly averages of 3,000, at high rates of flow has sometimes been difficult to handle with single coagulation. The plant extensions include generous secondary coagulation which handles all turbidities easily and with less coagulants. Hardness of the Kaw water fluctuates between 12 and 25 grains per gallon and, together with the well water (when used) necessitates a rigid softening control.

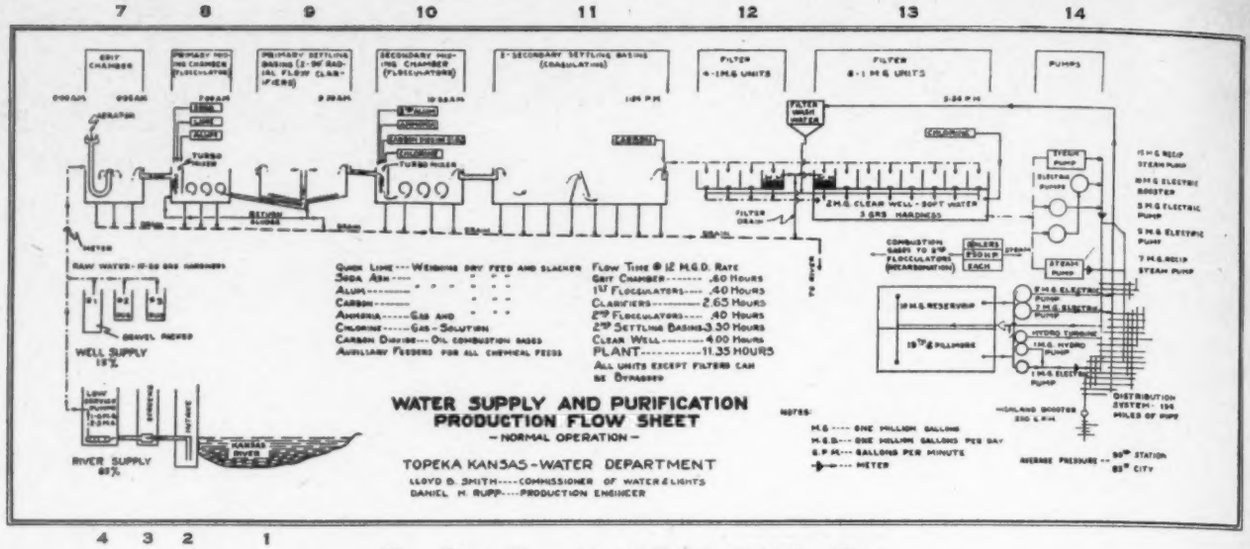
Tastes and odors of organic or vegetable origin which come with the general thaw are severe every few years. Coagulation with alum, carbon in two stages, pre-ammoniation and pre-chlorination have not completely solved the problem. The presence of algae in the river has usually been handled with double coagulation.

The finished water is non-incrusting and non-corrosive in the cold, but is somewhat so in hot water tanks. The maintenance of a pH value of 9.0 to 9.1 greatly improves this condition. In some hot water coils a hard deposit of magnesium silicate forms. Treatment to reduce the magnesium to lesser amounts and the use of higher dosages of coagulants to reduce the silicate improves this condition.

The Original Treatment Plant

The Topeka water purification plant was placed in service in 1923, consisting of a reinforced concrete in-

Topeka's Reconstructed Softening Plant—See Flow Sheet


WATER SUPPLY AND PURIFICATION
PRODUCTION FLOW SHEET
- NORMAL OPERATION -
TOPEKA KANSAS - WATER DEPARTMENT
LLOYD B. SMITH ---- COMMISSIONER OF WATER & LIGHTS
DANIEL M. RUPP ---- PRODUCTION ENGINEER
WELL SUPPLY 18%
RIVER SUPPLY 82%
Flow Time @ 12 M.G.D. Rate
Grit Chamber ..... .60 Hours
1st Flocculators .... .40 Hours
Clarifiers ..... 2.65 Hours
2nd Flocculators .... .40 Hours
2nd Settling Basins 3.30 Hours
Clear Well ..... 4.00 Hours
PLANT ..... 11.35 HOURS
2 M.G. CLEAR WELL - SOFT WATER
3 GRS HARDNESS
10 M.G. RESERVOIR
15TH & FILLMORE
DISTRIBUTION SYSTEM - 194 MILES OF PIPE

Flow Sheet—Reconstructed Topeka Softening Plant

take pier in the Kaw river with duplicate 24 inch suction lines through two pair of twin power-house type strainers, thence through one 30 inch suction pipe to two 3 m.g.d. and one 6 m.g.d. motor driven centrifugal pumps discharging through the steam turbine condenser to the treatment plant.

A multipan type aerator, later a 3 unit Aeromix, served for aeration. The silt or grit chamber provided one hour plain settling. The mixing-chamber (30 minute period) had 7 bays with simple rectangular frame mechanical agitators. The twin settling-basins were rectangular, provided straight flow, a 5 hour retention, were lateral underdrained with openings on 5 ft. centers. There were four roughing filters with beds of ⅛ in. Joplin chat operated at 4 gal./sq. ft./min. rate. The secondary coagulation basin was highly baffled and designed to maintain the 2nd alum floc in suspension, provided 1 hour detention. Then came the final eight finishing filters, of orthodox design with capacity of 1 m.g.d. each at 2 gals./sq. ft./min. The clear well located under plant and front yard had a capacity of 2 million gallons.

Recarbonation: Was added in 1930, the perforated pipe diffusor grid being located in the 2nd coag basin. CO_2 supplied from the oil fired boilers, combustion gases scrubbed in a concrete tower packed with brick bats and compressed with Nash Hytor rotary compressors.

Chemical Feeders: Originally Gaunt dry feeders fed hydrated lime and soda; alum was fed as solution. In 1929-30 dry feeders were installed for alum, Omega slacker and feeder for quick lime, Omega universal dry feeder for 2nd alum, Omega disc dry feeder for carbon.

Metering: One Simplex Venturi on the raw water; two on the filtered water pumps.

Chlorinators: W & T Vacuum type; two provide prechlorination (1930), one is for post chlorination.

Ammoniator: W & T ammoniator provides preammoniation; used continuously to guard against taste production in prechlorination.

Principal Plant Features and Operating Improvements

All extensions to the original plant have been based on 12 m.g.d. capacity, and all data mentioned subsequently are for that rate. It was desired that all the original basins and chambers should have some use in the revamped and extended plant.

The original plant was designed for a nominal capacity of 8 m.g.d. which was difficult to attain except under the most favorable raw water conditions. Six to seven m.g.d. could not be exceeded at times of unusual conditions under highly turbid and cold water. During high river stages it was practically impossible to cut a basin out of service for cleaning.

Original Grit Chamber (1 hr. retention) used as is with the exception of the addition of a sluice gate to bypass direct to the treated water conduit (this being the only gate used in the new extensions), an air grid for mixing when the mixing chamber is out of service, and also to assist in the mixing of the return sludge through the raw water when sludge return is practiced.

An Aerator Bypass is being installed. This will permit of low-lift pumping economies (approx. 1/5 of the lift). It is felt that the aerator is not necessary at all times and that the two flash mixers accomplish some aeration. Furthermore, when tastes and odors are severe chemical treatment is necessary to accomplish removal in any event.

Original Mixing Chamber (36 min. retention) the been removed. These had 8 hp. electric drive. A three wheel Dorrco Flocculator was installed with vertical shaft drive, reduction gear and four-speed 4 hp. motor, normally operating on third speed. This is a 5 hp. saving over the old equipment. To increase the barrel-roll effects, cypress baffles are hung between the flocculating paddles.

Primary Flash Mixer, consists of a Turbo-Dorrco Sextuplet, installed in a 4 by 4 ft. downtake at the mixing chamber inlet, terminating in 3 by 4 ft. submerged conduit on the chamber floor which conveys the flash mixed water, containing the softening agents, to the opposite end of the mixing chamber (reverse of the original layout). The chamber outlet is near the bottom through multiple ports. This was necessitated because the only available location for an outlet was in the basement of the adjoining building. The alum is added at the center flocculator wheel—i.e., half way through the flocculating stage.

Raw water without any lime treatment can be admitted in very limited amounts (not over several per cent of the flow) to the middle wheel—this in a sense provides split treatment. Alum can be added to this minor flow of raw water.

The flocculating equipment has resulted in the formation of a satisfactory floc which settles readily. The

primary flash mixer has not been used. This because the new mixer was intended to assist in the initial mix and give the flocculators more time under high rates of flow.

The New Clarifiers are located to the west of the settling basins. This necessitated long (250 ft.) conduits, which are about 3 by 5 ft. in section, and flow velocity of one foot per second. All conduits are reinforced concrete supported on piers set on the original cantilever spread footing of the old settling basin walls, and are covered and below the basin flow line. All conduit bends are as long radius as the location permitted. They are outboarded on the clarifier wall under the collecting flume. This treated water conduit terminates in a dividing well in which are the downtake legs of the 30 inch syphons feeding the Sifeed Clarifiers.

A ship's tiller divider is provided to apportion each Clarifier its share of the flow. Each downtake has cast-iron channels to take a plate stop gate as also do the clarifier outlets. It was thought that plate stop gates would be just as convenient as gate valves, which would in a short time become so incrusted as to become difficult to operate. It is expected that it will be necessary to use these stops only very rarely.

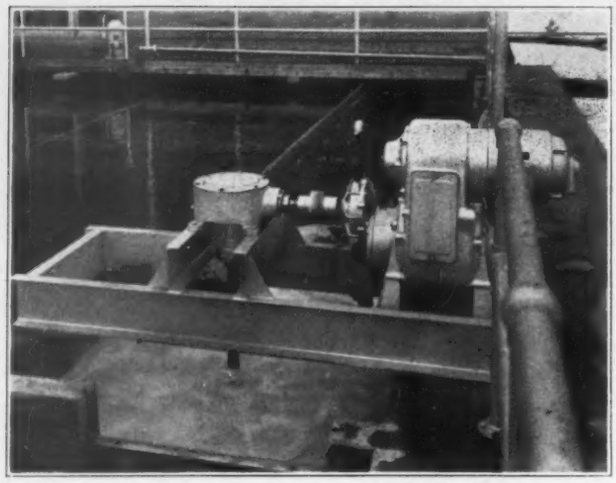
All manholes in the conduit and other places are equipped with stop log slots in the concrete and lined with sheet copper to make a smooth slide for stop logs. All stop logs are made from 2 inch tongued and grooved cypress, cleated, with lifting pins on both ends. They have worked very successfully.

The Two Sifeed Clarifiers (center feed, radial flow) 90 ft. dia., 14 ft. side water depth, 6 in. sludge drain, 12 in. side water drains, ¾ hp. vertical motor with Universal reduction gear, ball bearing turntable, adjustable steel weirs. Each tank 2.6 hrs. retention. All under water metal is painted with Bakelite Aluminum. All outdoor metal painted with Elasticote Aluminum which makes an unusually pleasing appearance. One Clarifier alone has handled a flow of 7.5 m.g.d. satisfactorily. The two clarifiers can be operated singly or in parallel, or both can be bypassed and the plant operated as originally built.

The Sludge Pump House is located below grade in the area between the clarifiers and the old basins, with stairway up to ground level and down to and through the drain tunnel between the old settling basins to the pipe gallery. A pipe well in which are located all sludge valves and drains and pump connections. All sludge valves are double disc gates with outside screw and yoke operated through floor stands.

A Barnes-Dorrco 75 g.p.m. sludge pump is provided to pump sludge to the high level filter sewer. When the river is at flood stage the basin drain must be gated off. Sludge can be returned to the mixing chamber or grit chamber. A Corliss type sludge dividing valve and box (designed by the writer) is located in the filter house floor over the primary mixing chamber to proportion sludge to mixing chamber or the sewer, permitting of lowest possible head on the sludge pump. An automatic sludge pump program clock is provided. Sludge can be, and usually is, discharged by gravity to the plant sewer.

Filter Operating Floor, Topeka Softening Plant



No. 2 Turbo-Flash Mixer—Used for Recarbonation and Secondary Alum Mix. The White Appearance Is Due to Air. On Left Is No. 2 Flocculator.

The sludge pump and clarifier controls are all mounted in the sludge pump house, all equipped with magnetic no voltage and overload releases and neon running lights and signal bell. It has not been necessary to heat this building.

The original second coagulating basin (one hour retention) has been converted to a secondary mixing chamber.

A Dorrco-Sterling-Turbo Flash Mixer driven by a 5 hp. motor through a variable speed reducer to a vertical shaft spinning an underfed impeller. The flash mixing well is 5 by 5 ft. square with a plate deck with a 26 in. hole under the impeller through which all the flow is pulled. The CO_2 is applied under this impeller through an open end pipe. This flash impeller effectively diffuses the gases and accomplishes recarbonation without need for non-corrodable diffuser grids. The secondary alum dosage is also applied at this point.

This flash mixer is powered and designed to act as a lift pump to gain a 6 inch head recovery, which will be desirable when the flumes in the old plant develop too much loss of head under high demand flows. The flash well is equipped with cast-iron channels for plate stops so the flow can discharge to the flocculators or to a submerged bypass conduit to the secondary settling basins, if and when the flocculator basin is out of service.

Provision has been made to admit raw water, in limited amount, to the recarbonation process. For short periods raw water, high in bicarbonates, has actually sufficiently reduced the causticity of the treated water without need for the admission of carbon dioxide.

A Dorrco Three-Wheel Flocculator driven by a vertical Universal reduction gear 3 hp. motor, 30 mins. mixing, with timber baffles (the original baffles in situ) occupies one-half the old secondary coagulating basin; the other half is just coagulation basin. Carbon is applied, when used, to the bay of the last flocculating wheel. The outlet is over a new concrete weir, thence through multiports into the old influent conduit to the secondary settling basins. The secondary flocculator will normally be in series with the second flash mixer, coagulating the secondary treatment ahead of the secondary settling, thence through to the filters.

The old valving and new flow control devices have all been retained, so that the roughing filters can be used as is, or in series between the 2nd settling and the 2nd flocculator mix, through to the final filters.

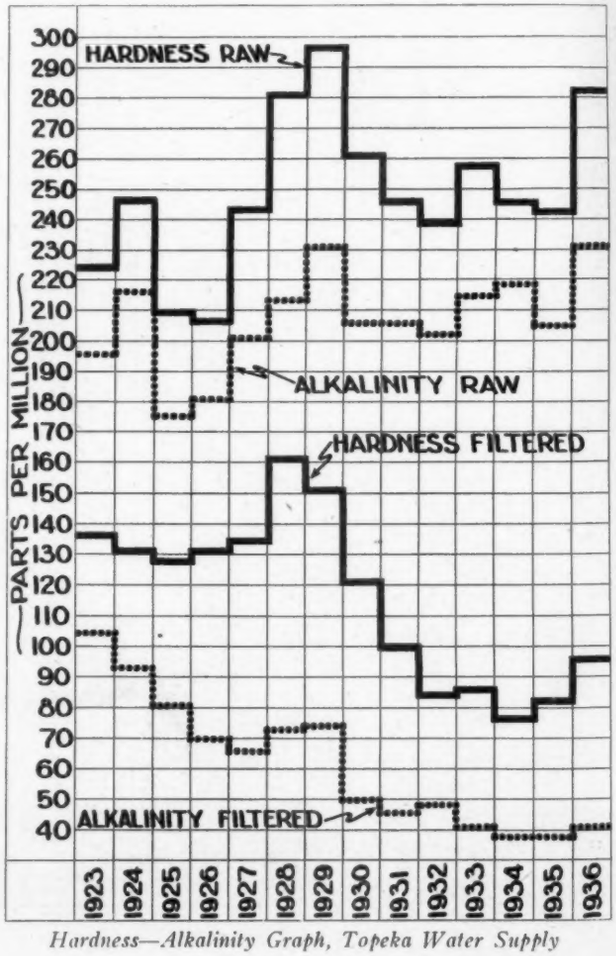
This necessitated a dual purpose collecting weir and flume. This flume is divided into two lineal sections, one of which is under fed through a slot in its floor. This was necessitated by the wide range of water levels caused by the loss of head by the roughing filters.

The roughing filters will soon be converted to final filters. This will make 12 m.g. nominal filter capacity and thereby a 12 m.g. plant. A cone plug valve will then be inserted in the floor between the upper and lower existing influent flumes.

The Original Settling Basins (5 hrs. retention, straight flow) are now secondary settling. Needless to say these basins now need cleaning infrequently, about once or twice a year, and the saving in blow down water is a considerable economy. The old records show from 3 to 10 per cent wastage incident to cleanings. This new layout is very flexible and permits of a thorough treatment and effecting real economies in chemicals.

The Electric Controls for the first and second flash mixers and flocculators, magnetic no voltage and overload releases and speed selector switches and thermal relays for each motor speed, and neon running lights for each unit and also for the sludge pump and clarifiers and signal bell, are all mounted on or in a metal cabinet on the operating floor.

Chemical Feeders: The Omega gravimetric type dry feeds for alum have proved reliable and accurate; the mechanical simplicity assures trouble-free operation. The scales are built in the feeder cabinet, and carries the extension hopper, charged from the floor above. Being completely assembled in the factory, requires no installation work, making a unit of pleasing appearance. The



Hardness—Alkalinity Graph, Topeka Water Supply

SOFTENING AND TREATMENT LOG, THROUGH PLANT STEPS

Example—typical day (4-2-37)

	—Alkalinities p.p.m. (all terms $CaCo_3$)—				——— Hardness ———			
	Total	Bicarb.	Norm. Carb.	Causticity	Magnesium	Non-Carb.	Total	Turbidity
Raw	199	195	4	0	87	44	243	2290
Treated (mixed)	82	0	56	26	..	..	...	...
Clarifier	97	0	74	23	..	..	...	...
Second mix (recarb.)	83	9	74	0	..	..	...	...
Settled	68	16	52	0	..	..	...	10
Filtered	35	11	24	0	21	50	85	0
Average of Typical Month (April, 1936)								
Raw	252	250	0	0	87	40	292	722
Treated (mixed)	71	0	50	21	..	..	...	...
Clarifier	66	0	50	16	..	..	...	...
Second mix (recarb.)	61	7	54	0	..	..	...	...
Settled	46	14	32	0	..	..	...	10
Filtered	39	5	34	0	28	55	94	0

RESIDUAL CHLORINE LOG

Typical Month

	January, 1937, Chlorine First*	March, 1937 Ammonia First
Settled (initial)	.39 p.p.m.	.31 p.p.m.
Filtered	.33 p.p.m.	.26 p.p.m.
Plant effluent	.23 p.p.m.	.20 p.p.m.
City tap	.17 p.p.m.	.16 p.p.m.
Reservoir	.05 p.p.m.	.10 p.p.m.

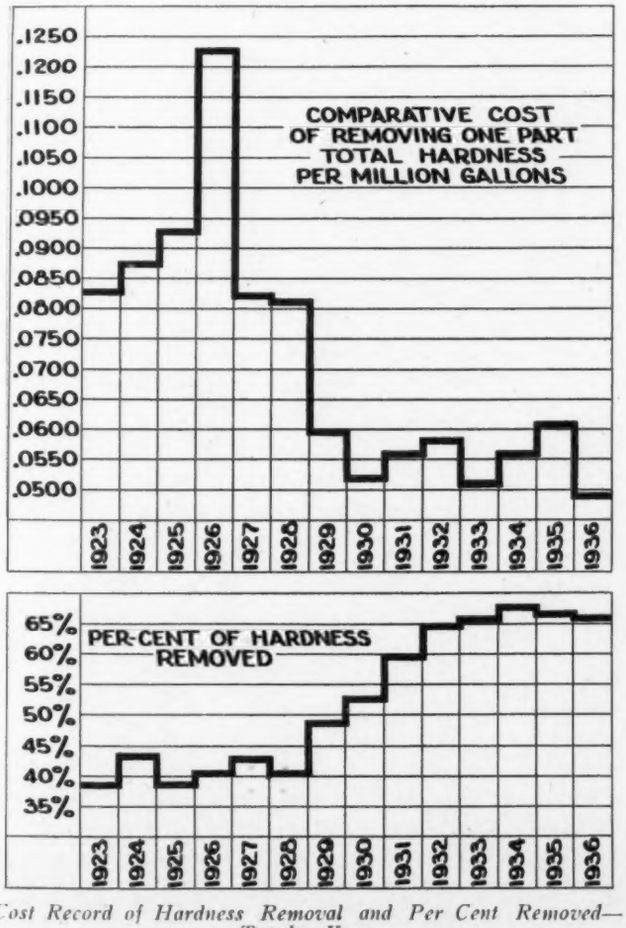
*31% more chlorine used in oxidation when chlorine applied first. No post chlorination.

straight line feeder adjustment makes for uniform increments of dosage.

The **Omega Universal** lime feeder and slacker with impeller jet agitated slacker, handling lump or crushed quick lime, complete with vapor and dust removal equipment and proportioned slacking water control, maintaining slacking temperatures of 180 to 200° F., has been in continuous service for five years. Recently the hopper has been scale mounted and attached to a weighing type controller to control the universal feeder.

An Omega gravimetric soda ash feeder is being installed; an Omega universal dry feeder handles the secondary alum; an Omega Disc type feeder is used to feed activated carbon.

A Cronoflow unit attached to the raw water Venturi tube is being installed to proportionally control the chemical feeders to keep in step with variations in the raw water flow.



Cost Record of Hardness Removal and Per Cent Removed—Topeka, Kans.

Efficiency Data Before and After Clarifier and Flocculator Installation

Period covered "Before" March, 1935—February, 1936, inclusive.

Period covered "After" May, 1936—February, 1937, inclusive.

All data converted to 12-month basis.

Using same Lime and Soda prices for both periods.

"Before"	$0.059	unit cost removing 1 ppm. total hardness per M.G. (Lime and Soda).
"After"	0.052	unit cost removing 1 ppm. total hardness per M.G. (Lime and Soda).
	0.007	unit removal "saving" equals 13.4% of softening costs.
	$2,479.00	Saving in lime and soda costs. 12 month period equals 13.4%.
	1,391.00	Saving in basin blow down and wash water costs (about 40% less volume needed).
	$3,870.00	Plant savings per year due to improvements.

The improvements cost about $60,000.00 and were paid for from surplus.

Design, Process and Layout, by the writer—Daniel H. Rupp, Production Engineer.

Design, Reinforced Concrete by Lloyd B. Smith, Commissioner of Water and Light Dept.

Contractor—George Senne.

Equipment was purchased and installed by the Water Department.

High early-strength cement was used throughout, because all concrete work was done in the winter season.

WHY WATER WORKS ASSOCIATIONS—HOW CAN THEY BEST SERVE?

THROUGH the long years many associations of men have been formed; many have died, but a few have survived and are flourishing. An examination of those now in existence shows that one thing they all have in common is that they render a worth-while service, and to some degree their activities are educational.

From this it may be inferred that water works associations survive primarily because they are educational. It also seems probable that the utility association rendering the highest service to the largest proportion of the utilities in its territory, and the most educational service to utility operators, will be the most successful.

Chief amongst the activities of the New England Water Works Association may be listed the following:

Papers and discussion at meetings.
Journal publication of such papers.
Superintendents' round table.
Chemists' round table.
Lectures on hydraulics—the school plan.

Monthly one-day meetings are held during the Winter and Spring.

The annual convention consists of four days devoted intensively to technical papers and informal discussion, plus manufacturers' exhibits of equipment and materials.

If we examine the membership list of an association and compare it with the total number of men working in this field who might and should become members, we may learn something about the steps that should be taken to render better service.

At every water association meeting will be found representatives from water utilities of different sizes. But, it will be noted that generally speaking, the nearer the meeting place to the smaller utilities, the greater the number of small utilities represented. In other words, representatives of large utilities are able to, and will, travel a greater distance to a meeting than representatives of small utilities.

There are water works operators whose duties, or financial status, will allow them to be gone only a part of a day. Generally such men are connected with the smaller utilities and it is reasonable to believe that these are the operators who would profit most from attendance at a meeting.

Perhaps fifty miles is the greatest distance that many operators of small utilities could travel to attend a meeting. Probably one hundred miles is as far as it is reasonable to expect most men to travel to sectional meetings. Surely, driving an automobile two hundred miles, and several hours' attendance at a meeting is a fair day's work.

These considerations lead to the opinion that water works meetings should be taken to places where more small operators can attend.

The desired frequency of meetings varies within some limits, but about six meetings yearly in any locality, or circuit of localities, would seem to fit the demand. The meetings might be bunched in the Winter, or spread out evenly through the year. Both methods are being successfully employed.

Water works schools are a form of association activity that seems to be on the increase. These are frankly educational, but do not differ greatly from a convention except that more attention is paid to study, less to play, more small operators are reached, and exhibits of equipment and materials are missing.

Nothing in this world is sure except change, and water works associations must change or be left behind. The changes must be in the direction of rendering better service to a larger proportion of water utilities. To attain this end, water works schools and association meetings must be carried to the water works operator.

Harry U. Fuller

President, New England Water Works Assn.

▼

Cleansing Filter Sand With Sulphur Dioxide Gas

On page 218 of our June issue we briefly reported on a method of cleansing filter beds with sulphur dioxide gas. The method was developed by J. G. Patrick, Chemist, West Va. Pulp and Paper Co., in his search for a method of removing manganese coatings on the sand grains of the Lake, Md., filter-plant and depositions on the interior of pipe lines serving the company's pulp and paper mill.

Briefly the procedure consisted of producing roughly a 3 per cent solution of sulphurous acid (H_2SO_3) by admitting sulphur dioxide gas (SO_2) into the manifold of the filter, while slowly filling the filter bed with water. After standing overnight the filter was washed hard and placed in service. Similar treatment was applied to the pipes. Explanation is that the sulphurous acid reduces and renders soluble the manganese and iron compounds, thus destroying the cementing effect of the highly insoluble manganic and ferric compounds which bind the organic or mud coatings.

The August issue of *"Taste and Odor Control"* (a monthly publication distributed gratis by Industrial Chemical Sales Division of West Va. Pulp and Paper Co., New York City) contains a description of the application of the Patrick process at the Baltimore, Md., filter plant, and presents results attained, costs, etc.

In the procedure at Baltimore, 1,950 pounds of sulphur dioxide was bled into the filter manifold header during filter-bed filling with water. This time, instead of the slower process of gas feed, the container was upended so as to feed the liquid sulphur dioxide through a ⅜ inch rubber hose, thus speeding up the application of sulphur dioxide sufficient to produce a solution of 1.86 per cent concentration in the bed.

Readers interested in details and accomplishments of the Baltimore application of the Patrick process, on request, can have a copy of *"Taste and Odor Control"* of August, 1937, as long as our supply lasts.

GAS ENGINE PERFORMANCE AT AURORA, ILL.

Part 2—Developments During Fourteen Months of Operation

By WALTER A. SPERRY

Superintendent,
Aurora Sanitary District, Aurora, Ill.

This article is contributed by Mr. Sperry as a follow-up to his earlier article—"The Gas Engine Installation of Aurora, Ill.," which appeared in our issue of January, 1937.

The first article describes the gas engines and the unique features of installation design, operation arrangements, and something of their performance. Especially noteworthy are the gas storage facilities and the Aurora-designed method of variable speed control of the engines, to automatically follow up and down, with variations in the sewage flow to be pumped.

The present article by Mr. Sperry, revealing many pertinent operating facts and long period performance and cost data, is now presented as Part 2 of his earlier article. The reader will gain much by a careful review of Part 1 (the January article), which contains a great deal of interest to gas engine users and prospective users.

Such contributions indicate clearly, what has often been said in these pages—It will pay every municipality, well, to have a "Sperry" in charge of its plants.—ED.

THE Aurora Sanitary District is now in its fifteenth month since entering "the land behind the looking glass." Like Alice, of old, we have found a wonderful country and it is now time to talk of our gas engine performance, costs and savings, and share our information with those interested.

The Aurora engine installation was completed and began operation March 30, 1936. The engines have been in continuous operation since that date.

Table 1 presents an analysis of their first cost.

TABLE 1—INSTALLATION COSTS

Inspection	$ 413.45	3.9%
Plans and specifications	367.05	2.7
Stenographic services	82.50	0.6
Legal services	157.00	1.1
Equipment cost	12,658.50	92.6
Total gross cost	$13,678.50	100.0
P. W. A. grant	5,157.00	37.8
Total net cost	$ 8,521.50	62.2

As revealed in Part 1 of this article, appearing in the January issue, it will be remembered that the Aurora engines were manufactured by the Climax Engine Company of Clinton, Iowa, and are of the four cycle, horizontal shaft, six cylinder, valve-in-head type. The cylinders are 6 by 7 inches. The engines are rated at 75 horsepower when running at 690 r.p.m. They were built to run as heavy duty continuous service engines at 1,000 to 1,200 r.p.m. Under the Aurora conditions they run from 500 to 800 r.p.m. They have light flywheels and no critical speeds. The compression ratio is 5.75 to 1.0 and they are built for a maximum mean effective pressure, at 24 hour service, of 7.2 lbs. per sq. in. The engines are, therefore, admirably adapted to the Aurora conditions and are working at ratings which give promise of long life.

Oil Consumption

The descriptive article of January 1937 explained the test method used for controlling the oil consumption. In the 14 month period reported herein, we have actually used 147½ gallons of oil. The five gallon oil charge, used, gave an average of 410 hours of service. This is equivalent to 2½ weeks of use where the engines are alternated on a 7 day, 23 hour schedule, or 168 hours. No attempt is made to recover the used oil, due to the small volume. The spent oil is used to augment the fuel oil reserve for the furnaces. Finally, it pays well, to frequently wash the oil filter felts with gasoline.

Gas Quality and Consumption

Table 2 presents the gas data for the period of April 1, 1936, to June 1, 1937.

TABLE 2—GAS CONSUMPTION

	—Cubic Feet— Total 14 Months	Per Day	Pct.
General house, laboratory and digestor heat	4,959,290	11,640	25.4
Consumed in engines	8,252,110	19,370	42.2
Incineration	3,986,700	9,360	20.4
Wasted	2,358,700	5,530	12.0
Total	19,556,800	45,900	100.0

The slight discrepancy between the 19,370 cubic feet of Table 1 and the 20,200 cubic feet of actual engine use per day is due to a few days when the gas engines were out of service due to plant problems—however, not involving engine operation.

The gas had an average value of 630 B.t.u. gross and 563 B.t.u. net. Junker calorimeter studies carried out in 1936, in parallel with Orsat calculated B.t.u. tests, showed that the net value of the gas is 90.7 per cent of the gross value.

The average hydrogen sulphide content of the Aurora gas for this same period follows:

	P.P.M.	Grains Per 100 Cu. Ft.	Per Cent by Weight
Maximum	981	51.6	0.113
Minimum	69	3.6	0.008
Average	296	15.6	0.033

The Aurora engines were installed without hydrogen sulphide scrubbers, believing the content was below the point where it would cause trouble. After nine months of operation the exhaust heat exchanger and the engine interiors were carefully examined. No evidence was

TABLE 3—OPERATING DATA—ENGINE NO. 1

Month 1936	Days in Service	R.P.M.	Flow M.G.D.	Cu. Ft. Gas Per 24 Hrs.	Cu. Ft. Gas Per 1 MG Hr.	BTU. Gas (Net)	Avg. H.P. Developed Per 24 Hrs.	Avg. H.P. Developed Per 1 M.G.	BTU Per BHP Hr.	Engine Cir. Water: Degrees F. Low	Engine Cir. Water: Degrees F. High	Digestor Cir. Water: Degrees F. Low	Digestor Cir. Water: Degrees F. Int.	Digestor Cir. Water: Degrees F. High	Digestor Cir. Water Gals. Per Day	Avg. % Heat Recovered
Apr.	11	607	7.33	20,750	118	566	47.6	6.50	10,300	129	140	107	110	112	145,800	49.5
May	14	588	6.34	16,160	102	584	38.9	6.14	9,986	134	139	101	102	103	146,540	35.0
June	16	572	5.56	17,290	131	558	32.7	5.89	12,286	127	132	103	104	106	145,520	45.1
July	19	584	6.13	18,757	127	588	37.4	6.10	12,280	130	135	112	114	115	144,050	38.0
Aug.	14	600	6.86	20,310	124	546	43.2	6.30	10,710	130	137	111	114	116	138,840	47.8
Sept.	13	609	6.08	21,277	146	566	36.9	6.07	13,605	137	144	121	124	125	143,630	39.6
Oct.	14	638	8.08	24,663	127	567	54.7	6.78	10,665	134	142	121	124	126	143,300	42.4
Nov.	10	604	7.76	20,885	112	570	52.0	6.20	9,535	130	137	117	120	121	145,770	42.4
Dec.	14	568	6.39	17,660	115	560	39.5	6.18	10,435	134	140	125	128	129	145,350	40.3
1937																
Jan.	14	601	6.96	19,165	115	562	44.1	6.33	10,170	131	138	118	121	122	145,500	46.0
Febr.	14	607	6.03	20,040	140	568	36.6	6.07	13,098	130	136	117	119	121	144,640	47.4
Mar.	15	610	7.04	20,720	133	546	44.8	6.38	11,335	132	140	126	129	130	145,290	44.6
Apr.	14	670	8.18	27,350	139	560	56.4	6.90	11,320	128	138	116	120	122	145,350	47.1
May	17	621	6.29	19,760	131	548	38.6	6.13	11,700	128	138	117	120	122	143,730	49.6
Avg.	14	605	6.79	20,342	125	563	43.1	6.32	11,240	131	138	115	118	119	144,480	43.9

TABLE 4—OPERATING DATA—ENGINE NO. 2

Month 1936	Days in Service	R.P.M.	Flow M.G.D.	Cu. Ft. Gas Per 24 Hrs.	Cu. Ft. Gas Per 1 MG Hr.	BTU. Gas (Net)	Avg. H.P. Developed Per 24 Hrs.	Avg. H.P. Developed Per 1 M.G.	BTU Per BHP Hr.	Engine Cir. Water: Degrees F. Low	Engine Cir. Water: Degrees F. High	Digestor Cir. Water: Degrees F. Low	Digestor Cir. Water: Degrees F. Int.	Digestor Cir. Water: Degrees F. High	Digestor Cir. Water Gals. Per Day	Avg. % Heat Recovered
Apr.	19	651	7.69	22,550	122	566	51.2	6.66	10,390	137	144	107	110	112	146,620	45.7
May	17	626	6.66	17,663	106	584	41.7	6.25	9,870	136	144	98	101	103	146,600	51.8
June	14	599	5.52	15,560	118	558	32.4	5.87	11,160	127	135	102	104	106	146,010	46.0
July	12	637	6.45	19,290	125	588	39.9	6.18	11,850	133	142	114	117	119	143,970	47.3
Aug.	17	628	6.27	18,335	122	546	38.4	6.32	10,865	130	135	109	110	111	142,150	31.8
Sept.	17	673	8.20	22,270	113	566	55.7	6.80	9,430	136	145	121	124	125	144,510	41.9
Oct.	12	662	7.73	23,822	128	567	51.4	6.65	10,945	135	143	121	124	126	144,310	40.7
Nov.	10	629	7.15	20,838	121	570	45.8	6.30	10,800	131	138	115	118	119	145,430	40.5
Dec.	17	631	6.80	18,666	114	560	42.8	6.30	10,180	134	141	126	129	130	145,230	38.2
1937																
Jan.	16	609	6.96	19,095	123	562	40.2	5.76	11,128	130	137	117	119	120	149,720	38.7
Febr.	15	610	5.97	18,250	126	568	36.1	6.05	11,832	130	136	116	118	119	144,400	45.8
Mar.	16	659	6.94	21,770	135	546	44.0	6.35	11,700	133	142	126	130	131	145,330	45.8
Apr.	16	700	7.01	23,074	138	560	44.5	6.34	12,095	126	138	112	115	117	144,750	47.4
May	14	654	6.55	20,710	132	548	40.8	6.23	11,540	131	142	121	124	126	144,300	50.8
Avg.	15	640	6.85	20,135	123	563	43.2	6.15	10,980	132	140	115	117	120	145,240	43.2

discovered, in either, to indicate any deleterious effects of sulphur. The heater was clean except for normal rusting and the cylinder walls were polished. Valves gave no evidence of pitting or corrosion.

General Engine Performance

Tables 3 and 4 present a rather complete analysis of the individual operation of both engines. These tables present the monthly summary of the daily records.

The engines drive two identical pumps of the American Well Works make, with bronze impellers, handling a clean liquor free from grit. These pumps are in alternate weekly service. For 22 months out of 72 they were not used due to discontinuance of secondary treatment. The remainder of the time they were on alternate service so that the actual total time of service has been less than two years since the time of installation. Under these conditions the efficiency of the pumps have not changed appreciably from the values on the test curves at the time of installation. In order, therefore, to arrive at a means of determining engine performance a careful series of tests were run in which tested gauges were used on the pumps for exact heads. The exact revolutions of the engines were obtained by use of a hand tachometer and the Venturi meter was checked and found to be within the usual three per cent tolerance limit. This data was furnished to the pump manufacturers who computed curves to indicate the present pump efficiency and horsepower requirements. These curves proved sufficiently identical, so a master set of curves was composited. This data was used for calculating the horsepower of the engines, as given, using the familiar formula:

$$\frac{\text{G.P.M.} \times \text{Head}}{4{,}000 \times \text{Efficiency}} = \text{Horsepower}$$

For the period reported the average pump efficiency has been approximately 72.6 per cent and the average head 26.2 feet.

While it is quite possible that this procedure may be open to some criticism it was not possible to approach the problem in any other way. Whatever the errors introduced may be it is felt that they are not large and

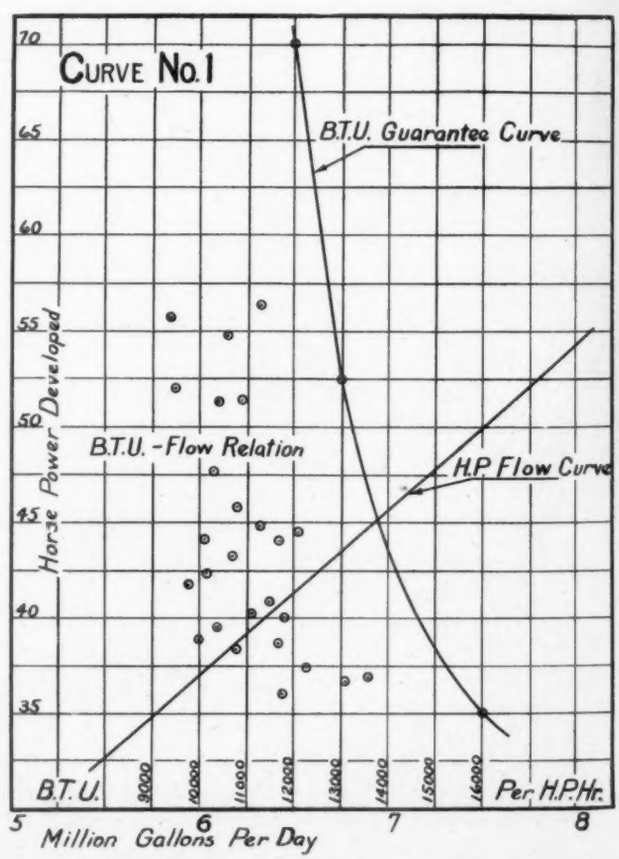


Fig. 1—Engine—Thermal Efficiency Curves

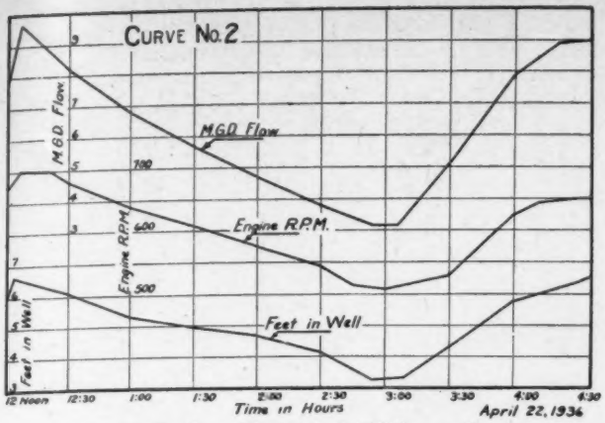


Fig. 2—Engine—Mechanical Efficiency Curves

that the data obtained presents a continuous, uniform comparison which fairly represents the actual facts.

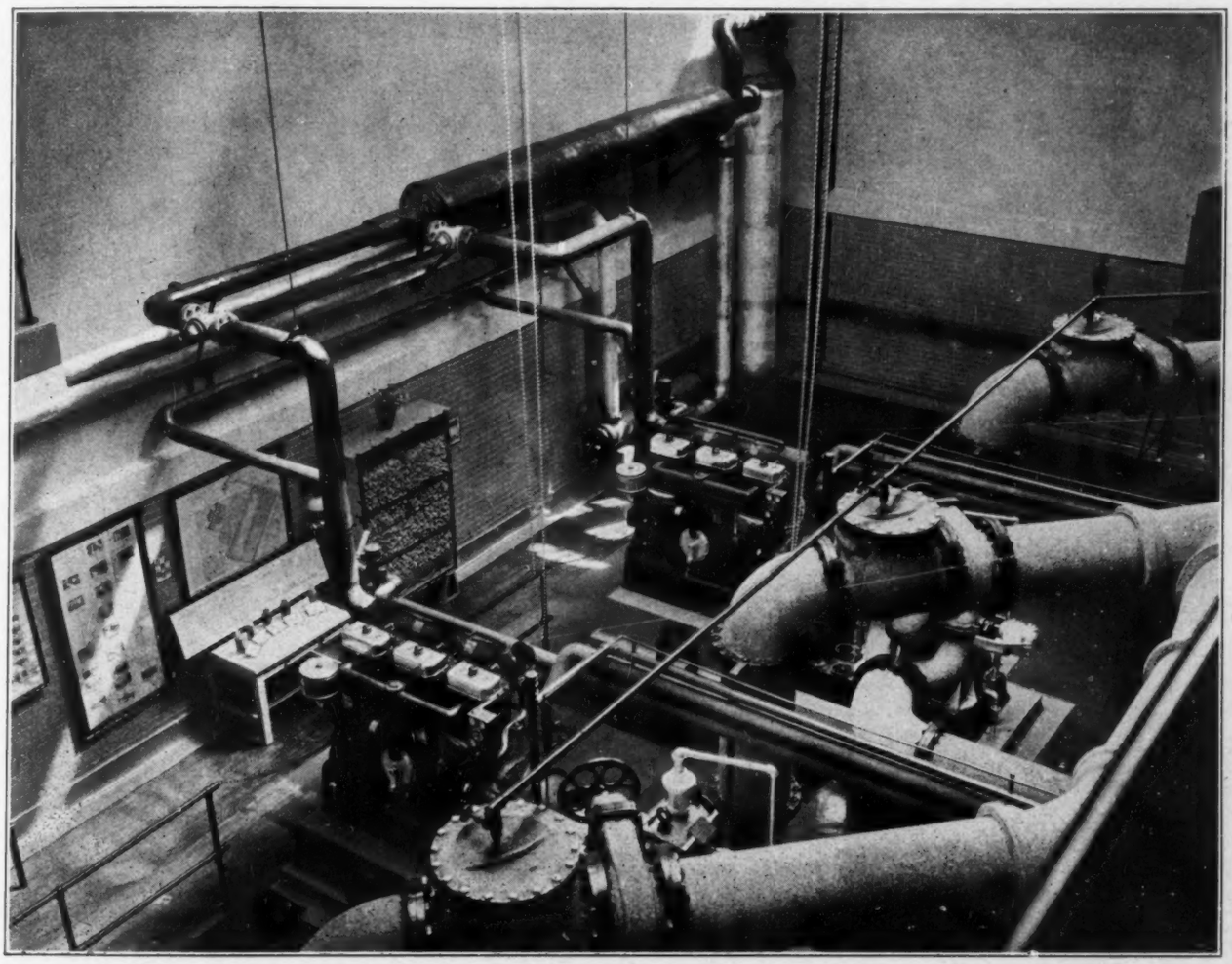
The r.p.m. and temperature relations are the average daily readings collected at 9 o'clock each morning. Gas consumption and flow records are based on meter readings. The heat recovery is based on the metered flow of water to the digestor system and the average monthly analysis of the gas, which is computed from weekly Orsat analyses.

Thermal Efficiency of the Engine

The thermal efficiency of the engine is presented in Curve No. 1 which shows the contract B.t.u. guarantees, together with the actual B.t.u. requirements of the engine. It also shows the relations between horsepower developed and r.p.m. The contract specifications were given on the assumption of constant speed, under which condition the engine was to develop full load at 12,000 B.t.u.; ¾ load at 13,000 and ½ load at 16,000 B.t.u. per brake horsepower hour. Since our engines operate on the variable speed control, developed by us for convenience and economy, their horsepower is adjusted automatically to the load. This accounts for the lower fuel consumption indicated in the curve.

Mechanical Performance of the Engine

The mechanical performance of the engine, as controlled by the just mentioned governor-float system of automatic speed variation (described in our article in the January issue), is indicated in Curve No. 2. This curve is typical of a number of studies of a similar nature. Over a period of several hours the flow was gradually diminished and then slowly increased. During this time observations were made on the changing speed of the engine and the changing level in the pump-well. The curve indicates the automatic adjustment of the engine to meet the changing conditions. On the average these studies indicate that for a flow change of 1 million gallons per day, the engines tend to adjust their speed by 25 r.p.m., with well levels changing approximately one-half foot. This device has worked perfectly and has needed no adjustment, to date. As indicated above,



Aurora's Gas Engines, Which Change Speed Automatically with Sewage Flow, Pump 3 to 12 M. G. D.

TABLE 5—SAVINGS EFFECTED BY GAS ENGINE OPERATION

	1935 January 1st-December 31st			1936-1937 — April 1st-March 31st —		
	Total Cost	Per Month	Per Cent	Total Cost	Per Month	Per Cent
Payrolls	$17,211.15	$1,434.27	60.3	$17,387.99	$1,448.99	75.6
Power	7,774.91	647.91	27.3	2,596.70	216.39	11.3
Truck	56.79	4.73	.2	69.70	5.81	.3
Phone	124.97	10.41	.4	127.13	10.59	.5
Office	258.08	21.51	.9	181.29	15.11	.8
Laboratory	157.34	13.17	.6	272.35	22.69	1.2
New equipment	1,046.07	87.11	3.7	517.03	43.08	2.2
Repairs	909.67	75.81	3.2	571.34	47.61	2.5
Gas engines	.....	.....	...	375.22	31.27	1.6
Miscellaneous	978.13	81.51	3.4	910.82	75.90	3.9
Total	$28,517.11	$2,376.43	100.0	$23.009.83	$1,917.48	100.0
Total power	$ 7,774.91			$ 2,596.70		
Benton & Holbrook Stations	443.86			473.70		
Net power and lights at plant	$ 7,331.05			$ 2,123.00		
Difference				$ 5,208.05		

TABLE 6—NET EARNINGS—12 MONTHS

Total cost of engines completely installed		$13,678.50
Gross savings in current for 12 months		5,208 05
Computation of Fixed Charges:		
Amortization at 12 yrs. at 4.0%	$ 910.94	
Maintenance and oil for 12 months	225.42	
Gasoline	None	
Interest on investment at 4.0%	547.14	
Total fixed charges		$ 1,683.50
Annual average electrical bill saved	$5,208.05	
Less annual total fixed charges	1,683.50	
Annual net profit		$ 3,524.55
Total fixed charges	$1,683.50	
Less amortization at 12 yrs. at 4.0%	910.94	
Annual operating expense		$ 772.56
Annual average electrical bill saved	$5,208.05	
Less annual operating expense	772.56	
Annual gross profit		$ 4,435.49

$\frac{\$4,435.49 \times 100}{\$13,678.50} = 32.4\%$ investment on total gross cost. Engines paid for in 3 years and 1 month; i. e., by April, 1939.

$\frac{\$4,435.49 \times 100}{\$8,521.50} = 52.0\%$ investment on total net cost. Engines paid for in 1 year and 11 months; i. e., by February, 1938.

this has increased the fuel economy to better than it would have been under fixed speed conditions.

Savings Effected

The savings effected through the use of the engines are developed by comparing the 12 month period of 1935 with the same 12 month period (April 1st-March 31st) of 1936-1937. These two periods compare identical plant operating conditions, with full secondary treatment. The daily average flow during 1935 was 7.2 million gallons against a daily average for the 1936-37 period of 6.82 million gallons.

Table 5 compares the two periods with reference to complete plant operation.

In general, total operating costs are reduced 19.3 per cent. As indicated at the end of the table about $450 worth of current, included in the plant operating costs is for lifting stations on the interceptor system, which must always be motor operated. The difference, therefore, between the net current bill for power and lights at the plant in the two periods is $5,208.05, a reduction of 71 per cent. This is a gross reduction in power bills of $434 per month.

The $375.22 indicated in the cost table for engine maintenance actually reduces to $225.43 for oil and maintenance supplies, such as spark plugs, gaskets, oil filter cartridge, etc. The remainder being for small items necessary for the completion of the engine unit, and should not properly be included in the above table.

It is not possible to present Table 6 showing the net earnings produced by the engines in the 12 month period under study.

Based on an annual gross profit of $4,435.49, we have a saving of $369.62 per month from which we are able to compute the value of Aurora gas for power as being 60.8 cts. per 1,000 cubic feet against current at 1.668 cts. per kilowatt hour for the 1935 period. Mr. Krause, of Peoria, computes that against coal at $2.50 per ton (10,000 B.t.u. value), this same gas is worth 8 cts. per 1,000 cubic feet for heating purposes.

In General

In general, Aurora's experience during the past 15 months has more than justified its venture with gas engines. No use has been made of the gas storage facilities to date. There has been no use of auxiliary fuel. We are, therefore, unable to present any operating data showing engine performance with gasoline fuel. During the entire period we have had an average wasteage of 12 per cent of the gas produced. There have been no interruptions of service, due to engine failure. No. 2 engine was opened after nine months of operation and closed again. No. 1 engine had its valves ground once in this period. There has been one change of spark plugs. No design or installation weakness has developed.

The engines are singularly well adapted to the Aurora conditions, as indicated in the opening paragraphs; by reason of their freedom from vibration, critical speeds and the moderate speed at which they operate as compared with the design speed of the engine. Once set in motion (granted continuous oil, fuel supply and cooling water), they require almost no attendance from one weekend to the next.

To date we have found but one feature of the general installation which might be improved upon. Were we planning again, we would choose water cooling pumps integral with the engines rather than the separate motor driven type used. More trouble has been experienced from the utility company's power interruption, than from any other source. This, because of interference with the circulating water pump motors.

Should we proceed, as is likely, to the installation of the engine-motor generator set, as predicted in the first article, to care for the scattered motor auxiliary load, we will likely be freed from storm interruptions, since there will be no outside circuits. Under this condition our circulating water problem will likely clear.

MAINTENANCE OF WATER METERS

The Forgotten Feature of the Water Works Field

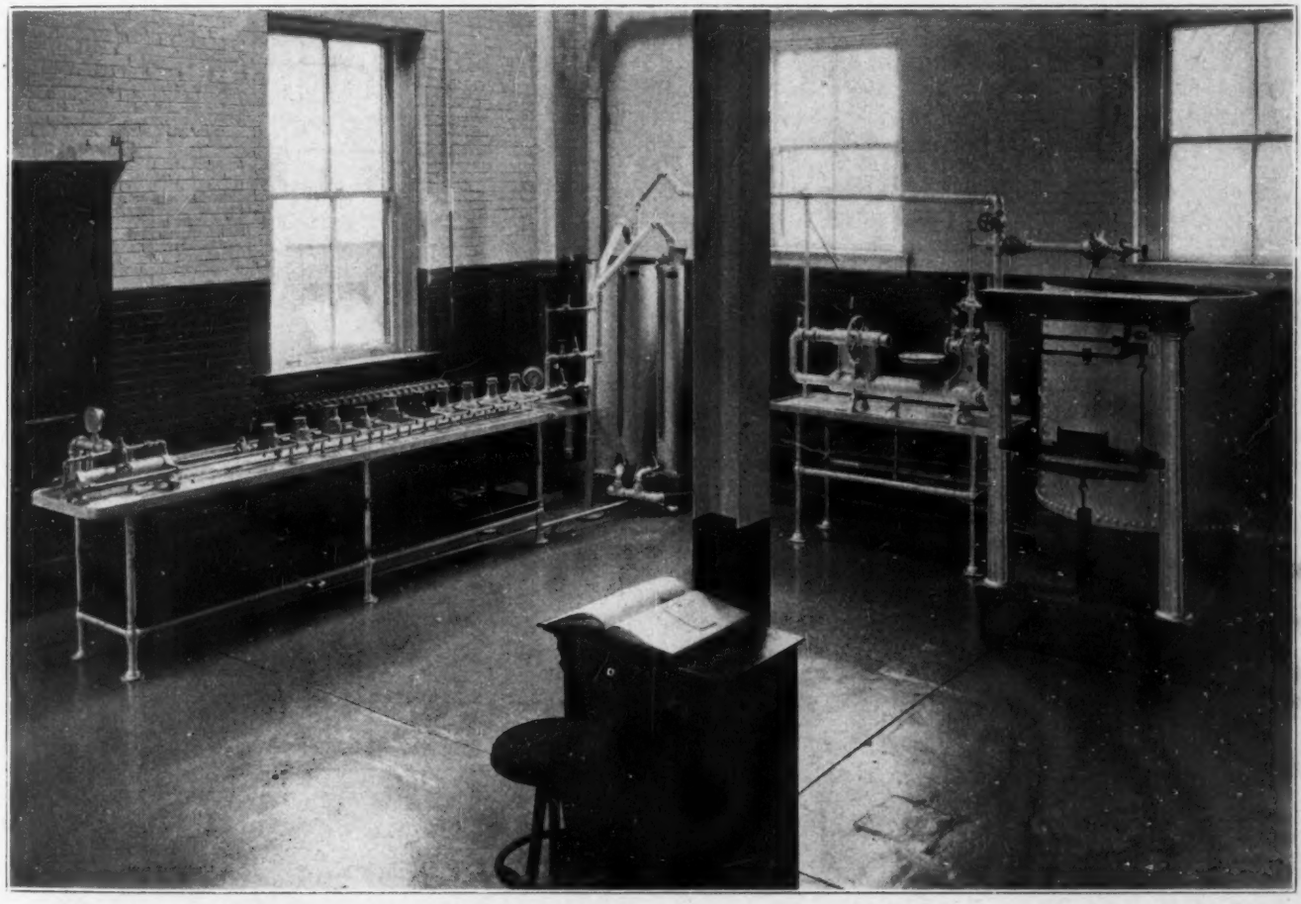
By CLEM. A. GALLAGHER
Supt. of Services and Meters,
Louisville, Kentucky

The Author

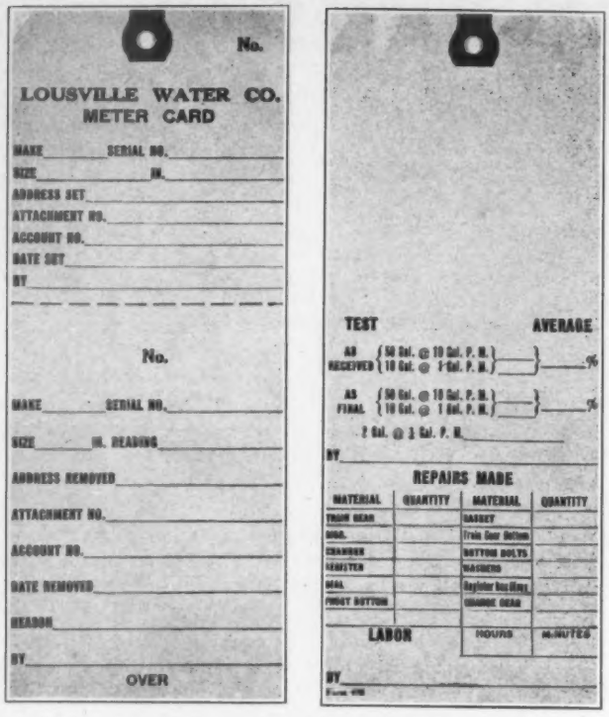
LEARNED men, who should know, say that love makes the world go round. Still, in my saner moments, I often doubt this assertion, and amusedly wonder if enigmas challenging the intelligence and ingenuity of the species "homo sapiens" are not really the wheels that make this orbit of ours revolve. Every man, every profession, every business has its enigmas.

The enigma that appears most difficult of solution to me is that of the average water utility. Every effort is made, and many thousands of good American dollars are spent to improve construction, pumpage, filtration, purification, administration, and other essential functions of a water utility. Every convention emphasizes these factors; every magazine aids their furtherance and perfection. Yet—and here's the paradox or enigma—that agent which produces all the revenue to keep all of these functioning is, as a rule, the most "forgotten feature" of the water works field. Less is known, less is said, less is done, for the water meter than for any other device of equivalent importance.

The two premises: (1) That sale of water by meter measurement is the only honest, dependable, and business-like procedure; (2) That, "as your meters go, so goes your revenue" are self-evident—the conclusions inescapble. Why then the paradox? Principally because many water works men fear metering programs. They are convinced that such a definite maintenance set-up is too expensive and too complicated. It is astounding how little is known about water meters amongst water works men whose bread and butter depend upon the faithful and accurate movements of an unimposing little register atop the meters. It was sadly significant to this writer that so many water works men could ask the question: "Can a water meter be repaired?"—and, be as sincere in this interrogation as a minister at an in-law's wedding. Many a helpless meter has been consigned to "junk" just because it stopped, when perhaps a particle of grit had hampered the disc or piston, or a register had become too tired of its fight with mud and grease. Fifteen minutes' work, perhaps, would have restored the meter to its original accuracy and endurance, if not good looks. The "forgotten feature" of



Test Benches and Calibrated Tanks, Louisville Meter Shop. (Only on Sundays and Holidays Does It Look This Way.)



Meter Tag—Front and Rear. Lower Half Is Record Stub Which Is Torn Off for Recording and Filing. Actual Tag Size is 8x3¼ in.

the water works field has been taking an awful beating while, in return, it has been paying the salaries of its assaulters. It is high and fitting time that something in the nature of a crusade, to give our meters a fair break, be inaugurated and consistently pursued.

There is no valid or even licit reason why every water utility, large or small, municipal or private, should not have a definite, efficient, and consistent meter testing and repair program. It is not expensive or complicated. It is cheaper and simpler, in proportion, than any other water works maintenance set-up. It is one of the very few programs in this life that will pay for itself, and leave dividends reminiscent of prosperity. More sins have been committed in the neglect of a meter program than in the good name of Charity.

Experience Proves the Contention

The meter program, as a unit, at the Louisville Water Company* has indisputably demonstrated many definite facts. Such a program is one of the greatest assets to any water company. It is reasonable to be proud of such a meter program, and the conclusion is positive that all meters can be, should be, and must be cleaned, repaired, and tested regularly to insure maximum accuracy and thereby maximum revenue. It has been found to be simple, practical, and profitable not to forget the meter. An intelligible account of our daily meter procedure may be of help to some wavering water works men. Such is the humble hope, and purpose in outlining the local meter process—from the ground, through the shop, and back to the ground. In such a definite program, four phases comprising the composite must be considered, and they shall be treated in order. Meters must be exchanged, tested, repaired and records kept of each and every operation.

It is self-evident that the most desirable method would be that which would insure an accurate and permanent record of a meter from the time it leaves the ground until it is returned thereto after thorough test and repair. In Louisville two men, with panel body trucks, exchange some seventy-five meters a day, and bring them to the shop. Another man and truck takes care of meter complaints, such as stopped meters, broken counters or glass, leaks, etc. A simple tag-card has been devised to contain all the very necessary recording—see cut. This tag is perforated midway and entwined with a wire at the top. The cards are numbered, and used and filed consecutively. On one side of the card at the top is a record for the meter reset after it has been repaired, tested and O.K.'d. Space is available for the make of the meter, the serial number, size, the address set, the service attachment number, the account or meter book and page number, the date set. The tag is then finally signed by the man placing the meter back in the ground. The lower half of the tag, on the same side, has the record of the meter removed. It reveals the make, serial number, size, reading, address removed from, service attachment number, account number, date removed, reason for removal (exchange, frozen, out of order, etc.) and space for the signature of the man removing the meter. On the other side of the tag, the upper half is blank, while the lower half contains a complete record of the meter test and repair. Each meter coming into the shop has this attached card wired to the casing, so that this same card remains with that one meter from the time it leaves the ground at one location until it is returned to the ground in another place. This plan obviates the danger of lost cards and garbled records.

Each meter received in the shop is tested as received, and finally tested after it has been repaired. Every meter is thoroughly cleaned and repaired irrespective of its incoming test performance. A removed ⅝ inch meter is tested with fifty gallons, at ten gallons a minute; and with ten gallons, at one gallon a minute. The meter tester places both percentages on his card as well as the average of the two. The meter is then sent to the repair bench to be cleaned and repaired. The lower half of the tag-card contains a list of the repairs made, parts replaced, and the time consumed. The material is listed on the card with a corresponding space for the quantity of each of the parts used, and the bin number from which it was taken. As a consequence, each man while repairing a meter, must put down just what new part, or parts, he used, how many parts were used and how long it took him to finish this one meter. The meter repair man then signs the card and the meter is returned to the testing table. It then goes through its final test of fifty gallons, at ten gallons a minute; of ten gallons, at one gallon a minute; and is then checked at one-quarter gallon a minute. The results are again noted and averaged, and this part of the card is then signed by the chief meter tester. If the meter does not register within two per cent, it is returned to the bench for a further overhauling.

When the meter has been shown to register satisfactorily, the record card is severed from the tag at the perforation marks and this lower half goes to the meter record office. This card contains, for the clerks in the meter record department, complete information in regard to this one particular meter, including its removal with all statistics on its testing and repair. The signature of each foreman definitely places responsibility for errors under each classification. The information from these cards is transcribed to the regular permanent meter cards and the tag-cards are then filed according to their test number. The top half of the card remains on the meter until it is taken out to be reset. Then the man resetting this meter or exchanging it for another re-

*The Louisville Water Company is the old name continued of the now municipally owned utility.—Ed.

SERIAL NO. 738416 SIZE 5/8" MAKE ——
PURCHASED March 1930 COST $ 9.00 TYPE ——

DATE SET	LOCATION	ACCT. NO.	REMOVED DATE	REMOVED READING	TESTED DATE	TESTED NO.	TESTED RESULT	REPAIRS
5/10/30	1709 - Portland	D-0279	9/25	347,000	10/25	2631	98%	$.51
4/3/35	411-W. Chestnut	K-021						

FORM NO. 245-A LOUISVILLE WATER CO. METER HISTORY

Meter History Card (Yellow). Same Form Is Printed on Rear for Continuing Record.

moves, fills out, signs and returns the card with the reset information to the meter record department. We thus have a complete cycle for our exchange program and by the use of this simple tag-card we have not only a method of double checking each step, but also of definitely placing responsibility where it should be placed.

This exchange system, simple as it is, has worked out most successfully for us and should do so for others. The men exchanging meters take out each day just as many tested and repaired meters as they will exchange, thus keeping the shop free from meters piling up. At our present speed, each of our 51,000 meters will be put through this process once every five years, although our tests (with our water and our meters) show that this period between tests could be lengthened appreciably, and probably should be.

Test Procedure

Next we come to the testing of a water meter. As I have explained above, a meter is tested as received and after being repaired. The size stream for the test depends, of course, upon the size of the meter. Our meter testing table (see cut) can test ten 5/8 inch, 3/4 inch or 1 inch meters at a time. On an adjoining bench, the larger meters up to six inches are tested one at a time. We have done away with the slower method of weighing for tests, and use only calibrated tanks and funnels. An hydraulic plunger keeps the meters in place. This test bench is so arranged that we can vary the water stream anywhere from 225 gallons per minute down to 1/320 of a gallon a minute. The low flow rate is secured by means of needle valves.

Recently, we have standardized on the sweep hand dials on all meters, for two very definite reasons. First, it is much easier to detect a leak on any size meter if it is equipped with a sweep hand dial. Second, and even more important, it facilitates the testing of a meter, both in time saved and assurance that our registers are accurate. We could not be sure of this by the use of test dials. Our meter tester and his helper average over one hundred 5/8 inch meters a day on standard tests. A cycle is likewise completed here, since in the morning, repaired meters are tested and in the afternoon meters are tested as received. Thus the repair men on the bench work each day on tested meters received the previous afternoon; while, in the morning, the meter tester passes on the meters repaired the previous day. It is noteworthy that our records show that less than one per cent of the total number of meters repaired are unfit after repair, or have to be returned to the bench. The promiscuous use of change gears is undesirable and we try to get away from it as much as possible.

The next step in our meter set-up, is our repair bench. Five men work on this bench. Each man has his own set of tools, his own sink with running hot and cold water, his own brushes and hose, with a stop valve carrying compressed air of about seven to ten pounds pressure. This air is simply piped from our garage and pressure reduced in the meter shop by means of a reducing valve. We have found that compressed air at this pressure, is most useful and practical for testing out the running smoothness of a meter, as well as ejecting particles which may be holding back the best performance of a meter. It likewise does away with the necessity of the men placing their mouths on the outlet or inlet to a meter. The meter bench is made of wood and covered with heavy galvanized iron. Above each man is an electric reflector which evenly lights up his place of work just where he needs it most. Each meter is placed in a separate pan to do away with the loss or mixing up of parts. Our manner of cleaning a meter is simply the old fashioned, but effective, soap and water method. We deprecate the use of acid on any meters, or parts thereof, unless it is absolutely necessary. We found, under our own water conditions, that the encrustation can be satisfactorily and more safely removed by hot water, soap and good old "elbow grease." We do no machining or reboring, as generally for smaller sizes replacement is cheaper and safer from every angle. Above the repair benches are marked and lettered compartments for the various parts of each size and make of meter. This arrangement is part of our permanent running inventory system. Each closed bin contains a different part and each bin is numbered. When the men need any new part for any meter, they must mark on their ticket the number of such parts used as well as the bin number from which it was taken. A regular inventory clerk can thus keep, from these cards, a daily record of just what parts were used and how many of each part remain in stock. He has a standard minimum of each part that should be kept in stock, and can daily or at a moment's notice, notify the department head what parts are needed, and how many of each, so they can be requisitioned and ordered. Again, this inventory system, though simplicity itself affords an easy check on costs, new parts required, etc.

Each man averages between fifteen and twenty meters a day, completely cleaned and repaired. The average cost, not including overhead, runs about fifty cents a meter for tests and repairs. We use about fifty new discs a month, and bottom bolts and gaskets most often need replacement. A meter is scrapped only after its retention is shown to be a liability. We have sent out some meters, after overhauling and cleaning, which have been in the ground forty years and more. One man at another bench, takes care of the registers, setting back to zero, lubrication, etc. We solder the counters and thus avoid ruining the gears by running counters

HENRY HOFMANN. AGT. D-0279 SIZE 5/8"
314 ARMORY PL. 10784
1709 PORTLAND.
BET. 17TH & 18TH.

MAKE	SERIAL NO.	INSTALLED DATE	INSTALLED READING	REMOVED DATE	REMOVED READING	TESTED DATE	TESTED NUMBER	TESTED RESULT
——	738416	5/10/30	0	9/25	347,000	10/25	2631	98.8%

FORM NO. 275 LOUISVILLE WATER CO. CONSUMER'S METER RECORD

Consumer's Meter Record Card (White). Same Form Is Printed on Rear for Continuing Record.

back speedily with a motor driven disc. After cleaning, the registers of all meters are dipped in hot oil and then drained. This oil is fine, and not too thick for frigid weather.

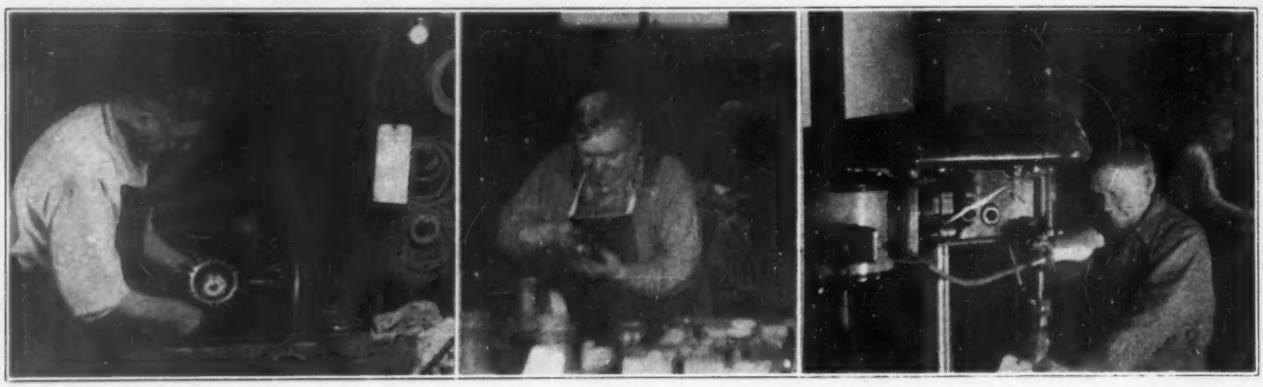
The meter shop is kept clean and each man knows just what he must clean up before he leaves, as the work has been divided. The floor is waxed and a heavy, linked rubber carpet stretches all along the repair and test benches. On Saturday of each week, larger meters (one inch to six inch) are tested and repaired. A healthy spirit of competition, a desire to keep the meter shop clean, and a pride in repair average, can work wonders if engendered and encouraged. On the same floor is our enclosed meter record office.

The head of the Meter Department and clerks keep all records of all meters. We keep two cards on each meter—one according to make and serial number; one according to the book and page number in the meter readers' books. All information—address, make, size, serial number, purchase date and price, sets and resets, tests and repairs, are kept on these cards—(see cut). Any information concerning any meter in service at any address, any meter in the stock room, or in the shop, is available at all times. The city is divided into districts, lettered alphabetically, and a reference from card to meter book gives all information concerning readings, leaks, etc. The two sections of the numbered cards are filed separately after the information thereon has been transcribed to the other set of cards. These test and repair cards give the final shop information on any particular meter. This system of checks and balances assures accuracy, permanency, and simplicity. All necessary information is always at hand and any meter can be traced from the moment we receive it until we scrap it.

Concerning Selection of Meters

We have at present in the ground approximately 51,000 meters. We are about 76 per cent metered. When purchasing a water meter, three things must be taken into consideration. These are—accuracy, endurance and interchangeability. It was our desire to find out just what meters would be most dependable under our water conditions and with this idea in mind, we conducted a series of tests with new stock meters. Ten of each make are tested at a time. They are tested as received on flows of ten gallons a minute, one gallon a minute, one-fourth gallon a minute. These same ten meters are then placed in an endurance test box in the basement and the water used in our building allowed to run through them until they register an average of five hundred thousand gallons. We can vary this flow in the building as desired.

The meters are then taken back to the shop and the first test schedule repeated. These figures are then averaged, with emphasis on the average percentage of inaccuracy, and blue prints made for permanent records. New meters can be taken apart and their parts interchanged. They are run then for approximately one hundred thousand gallons and retested, again according to the first test schedule. Again, they can be run on an absolute endurance test which, of course, takes time until one or more meters in any series breaks down. The meter that fails is then taken apart and the cause of such break down investigated. In this manner we have obtained, for most standard makes of water meter, very enlightening and most practical figures and facts. We have likewise made experimental use of the Ford "gulper," as we can run very small streams, record them in the calibrated tank, check the "gulper" and check the other meters in the series against this total. Our endurance test box in the basement is so constructed that it will hold twenty-five meters at one time. It is arranged in a series of two boxes and any one or more meters under test, can be removed at any time by means of valves, without affecting the flow of water in the building.



Work-a-Day in Louisville's Shop—Repair, Inspection, Drilling.

Our figures from many of these tests have been most startling, and seem to prove one thing very conclusively—that the A.W.W.A. specifications for 5/8 inch cold water meters are entirely too lenient. A well constructed water meter should register much better than 90 per cent on a one-fourth gallon per minute stream. We recently made a meter under-registration survey. We brought into the shop, at one time, three hundred meters which had been in service five years or longer and tested them as received. The averages were startling inasmuch as the average percentage of inaccuracy on all flows for all meters, up to and including a one-fourth gallon per minute flow, was far above standard requirements for new meters. It has been our endeavor in this entire meter set-up, to aim first at thoroughness, but thoroughness through simplicity. We believe we have accomplished our goal and through the cycles described in this paper, are able to test and repair water meters regularly, accurately, efficiently and economically. The cost of this program will be as nothing compared with the revenue pickup naturally consequent on such a program—not to mention the life added to the meters.

Any water utility that neglects to maintain a definite regular meter test and repair program, is neglecting what should be considered its greatest asset. As your meters go—so goes your revenue. A water meter can be tested, repaired and kept in shape. Like everything else in life, so with water meters—the simplest and safest way is the best and the cheapest way.

POLLUTION OF RIVER RAISIN BY BEET-SUGAR FACTORY WASTES

By W. D. LOREAUX

Supt. of Water Works,
Dundee, Michigan

RANKING HIGH in importance among the many problems resulting from denser populations and industrialization has been the disposal of the rapidly increasing amounts of domestic and industrial sewage. The easy and original method of disposal was, and still is in many instances, drainage to the nearest stream or body of water, the result being pollution of our natural bodies of water which has grown continually graver and more serious each year.

Fortunately, most municipalities of any size have sewage disposal plants which take care of the domestic sewage and at least some of the industrial wastes. Because of the lag in industrial waste disposal, many water supplies have become practically unfit for domestic use.

The River Raisin, which is the raw water supply of Dundee, Michigan, is being polluted in various stages of its course by only partially treated or raw domestic sewage and industrial wastes. The major portion of the pollution affecting the Dundee water softening plant is caused by wastes from a beet sugar factory located at Blissfield, Michigan. These wastes travel some forty-odd miles from where they enter the river to the intake of the Dundee filtration plant. Because of the level country, very little other than non-turbulent surface aeration of the river water occurs.

Strange as it may now seem, River Raisin formerly had the reputation of being one of the best bass fishing streams in the state. The high degree of pollution, which recurs almost yearly, from the sugar factory wastes has made a considerable portion of this stream a habitat mainly for carp and suckers.

Kinds of Sugar Factory Wastes

The sugar campaign usually begins the latter part of September and continues for 90 to 120 days. Certain wastes enter the River Raisin at the start of and continue uninterrupted throughout the campaign. After this, there is a tapering off for a month or two, then other wastes which have been impounded in ponds are released. The entire period of waste drainage is eight to nine months of the year.

There are four main wastes from the Blissfield sugar plant, viz.:

1. Flume water,
2. Process water,
3. Lime cake,
4. Steffen's waste.

The **flume water** is the water used to convey the beets in flumes from the storage bins to the factory, and also includes the water used in washing the beets. This waste contains a considerable amount of suspended matter in the form of soil, leaf and root particles and portions of decomposed beets. These settle on the river bed, there partially decompose, and are picked up by the Winter and Spring freshets to be carried further down stream.

The **process water** is the water used in washing the battery units after the sugar has been extracted from the slicings or pulp, and also includes the pulp press water. The combined flume and process waters are returned directly to the river.

The **lime cake** results from the treatment of the diffusion battery sugar solutions with carbon dioxide and lime. The lime is removed from the sugar solution by pressure filters and the lime cake thus obtained is puddled with water and pumped to a separate storage pond.

Steffen's Waste. The molasses, derived from previous crystallization processes, is treated with sufficient lime to produce tribasic lime saccharate and filtered. The filtrate, known as Steffen's waste, is impounded in a reservoir where more or less decomposition occurs. This waste is later drained into the river by degrees from the ponds.

Constituents of Sugar Factory Wastes

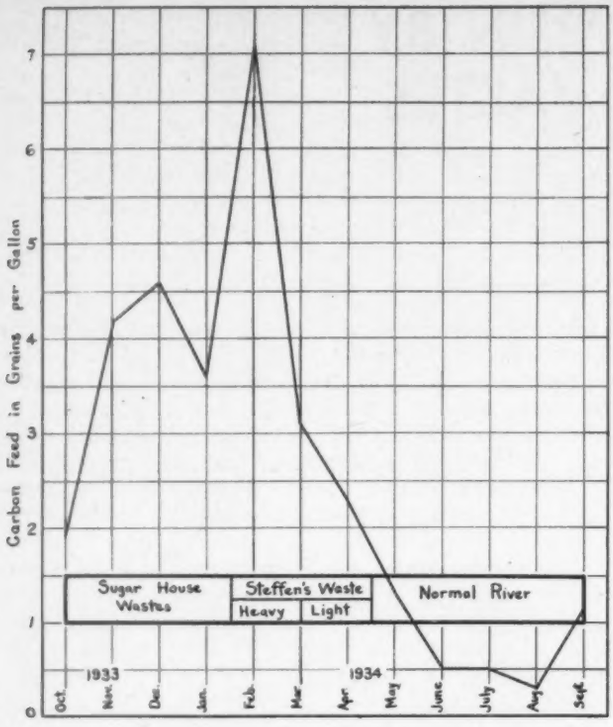
Theroux and Eldridge[1] state that 4.64 per cent of the weight of the beets sliced is lost through the wastes of the factory processes. These investigators give the following results (Table 1) of the analyses of a number of samples taken from Michigan factories.

It can readily be seen that the flume water is low in those constituents that would create undesirable pollution and, taken alone, after proper settling and screening, would have very slight effect upon the raw water supply. However, when augmented by the process water, which is much higher in organic matter, the combined effect is such as to frequently reduce the dissolved oxygen content of the raw water to a very low amount as shown by the DO. and 5-day BOD. curve sheet. The liquors from the lime-cake pond add some organic matter and considerable alkalinity when finally drained into the raw water supply. The Steffen's waste is by

TABLE 1.

	Process Water					*Composite**	
	Flume Water	Battery Wash	Pulp Press	Lime Cake	Steff. Waste	Straight House	With Steffen's
Gals. per Ton of Beets	2200	410	250	75	98	2935	3033
5-day BOD (ppm.)	200	700	2050	1420	54000	455	2192
Oxygen demand (ppm.)	110	250	1320	500	10500	242	477
Total solids (ppm.)	1580	1290	3740	3310	43600	1768	3124
Suspended solids (ppm.)	800	210	2560	450	700	863	859
Dissolved solids (ppm.)*	780	1080	1180	2860	42900	905	2265

*Computed by Milton P. Adams, Sec., Mich. Stream Control Comm.
Note: Ordinary sewage strength varies from 150-200 ppm. BOD.



Sheet 1—Average Carbon Feed at Dundee Filtration Plant—Month to Month. Effects of Sugar Mill Wastes Shown.

far the most troublesome waste because of its high content of putrescible organic matters, resulting in intense tastes and odors and in high oxygen demanding qualities.

Effects of Such Wastes on Water Purification Plant Operation

From the Dundee water plant operator's point of view, there are but two sugar factory wastes, namely:

(1) Those wastes which are carried directly to the river during the sugar campaign and are composed of the combined flume, wash and process waters, and,

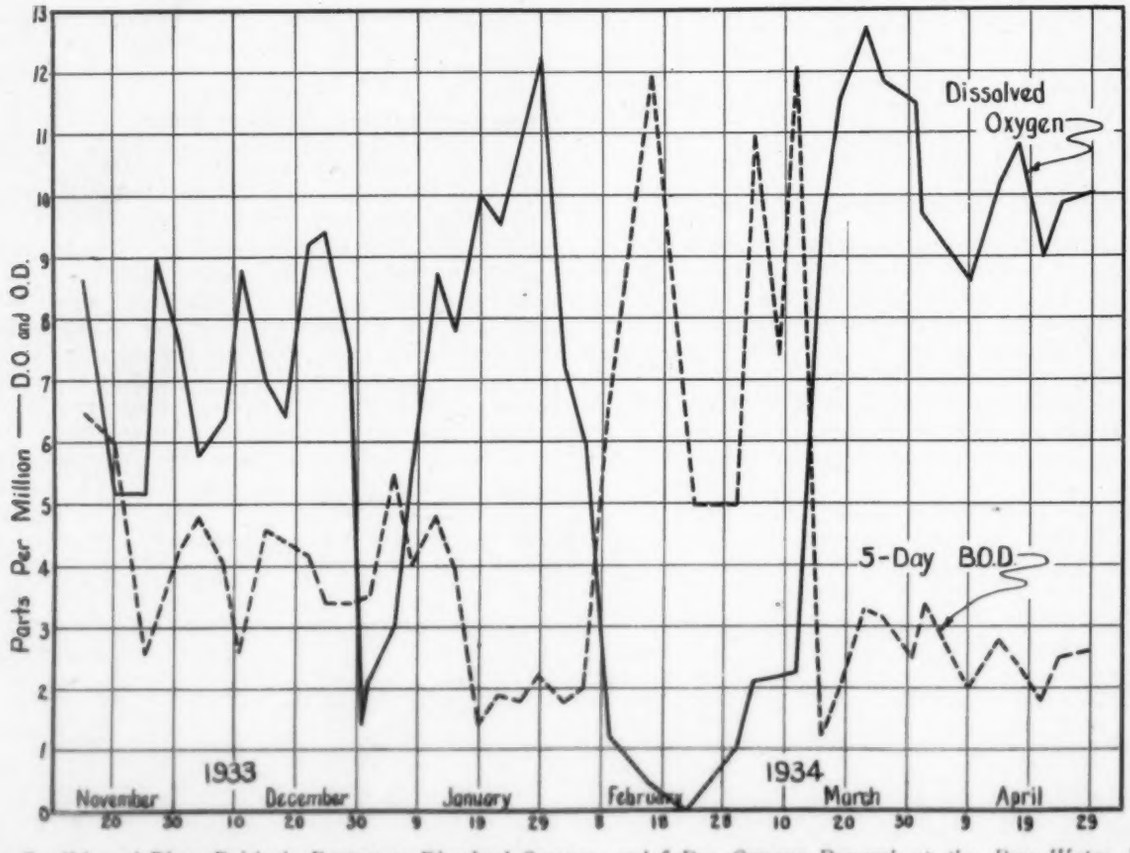
(2) The impounded (ponded) wastes composed of the Steffen's waste and the overflow from the lime-cake pond.

The first of these wastes imparts a sweetish beety odor to the raw water, when heated. This odor frequently resists the water plant purification treatment, as attested by a much diminished, yet distinct beety odor at the domestic hot water taps.

The Steffen's waste has a very putrid odor and is very difficult to handle in the water purification plant when exceeding certain low concentrations. Sometimes, as occurred in February, 1934, when the banks of the Steffen's pond broke and drained a large portion of its contents into the river, it is impossible to remove the taste and odor with activated carbon application as high as 12.5 grains per gallon. This coincides with a statement in the Proceedings of the American Society of Civil Engineers for April, 1935, which is as follows: "Thus far the tastes and odors from certain liquors from beet sugar refineries have been found to be *not* removable by any quantities of carbon that may be used."

The carbon feed sheet gives the average monthly dosage and shows the greatly increased quantities of carbon required during the sugar campaign. (Curve Sheet No. 1.)

The DO-BOD curve sheet shows that both these



Sheet 2—Condition of River Raisin in Respect to Dissolved Oxygen, and 5-Day Oxygen Demand at the Raw Water Intake of Dundee's Filter Plant. (Conditions in February Due to Break in Steffen's Waste Holding Ponds).

wastes impart at times a very high BOD. value to our raw water. They also add considerable colloidal material which at times makes coagulation difficult. (Curve Sheet No. 2.)

The relative magnitude of the polluting effect of the wastes from a beet sugar factory is given in the Second Biennial Report of the Michigan Stream Control Commission as follows: "On the basis of the figures (Table 1) and using the value of 0.167 pounds of 5-day oxygen demand per person per day, it is computed that the waste from a 1,000-ton beet sugar factory is equivalent to the sewage from a city of 146,000 people, but with simultaneous discharge of the Steffen's waste, the population equivalent increases to 554,000."

The Blissfield sugar plant has a normal capacity of 1,200 tons of beets daily, but contemplates increasing to 1,400 tons. Adding 40 per cent to the above values, we have the population equivalent of sewage pollution from a city of 204,000 and 780,000, respectively. River Raisin is a comparatively small stream and with this proposed increase in the operation of the sugar factory, the burden of the equivalent sewage load will make the operation of any water treatment plant, using this stream as its source of raw water, very difficult.

Methods of Eliminating These Wastes from the Raw Water Supply

Many remedies have been proposed for the disposal of beet sugar factory wastes. Theroux and Eldridge[1], from their 1931 survey, draw the following conclusions regarding the four major wastes:

1. The disposal of these wastes may be accomplished by: elimination, re-use, treatment, utilization, or dilution.

2. Elimination of the lime-cake drainage is possible in most cases by conveying the cake to the field by some other means than water transportation.

3. Diffusion battery wash-water and pulp press water can be eliminated by the use of continuous diffusion in place of battery diffusers. The process is, however, more expensive and less efficient in the extraction of sugar.

4. Re-use of flume water after clarification, is possible, but not practicable unless water is scarce. Discharge of the clarified waste into a stream continuously is much better practice than the discharge of the water after re-use has caused the accumulation of solids in solution.

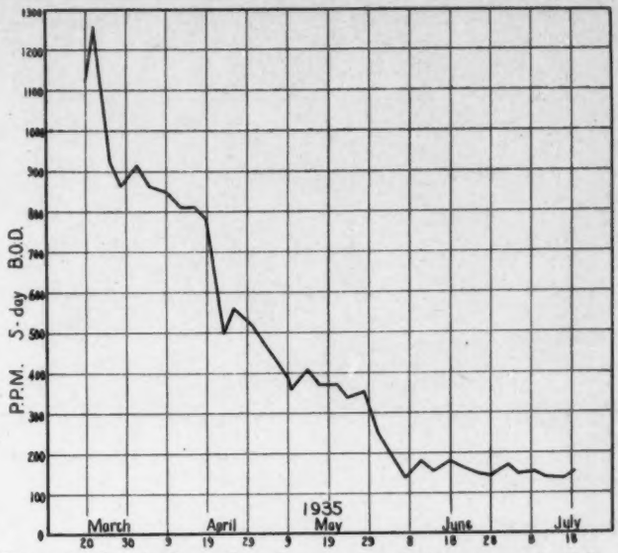
5. Re-use of the process water is practical to some extent, but the accumulation of foreign materials will eventually interfere with the purification of the sugar.

6. Treatment of flume water should consist of efficient clarification, rapidly accomplished by means of screens and settling tanks. The settling basins should be equipped for continuous sludge removal or may consist of ponds arranged in parallel.

7. The treatment of process water should be carried out separately from the flume water. The methods for the treatment of this waste will require further study before they can be applied. Controlled fermentation and biological filtration have been attempted with some degree of success.

8. The treatment of Steffen's waste would be very difficult and costly.

9. The utilization of Steffen's waste should be attempted with the idea of finding some market for the disposal of the by-products. Potash seems to be the principal by-product of value, and the fertilizer market the most promising outlet.



Sheet 3—Graph Revealing Progressive Improvement in 5-Day Oxygen Demand of Ponded Steffen's Waste During 90 Days of Storage at the Blissfield Mill.

10. Adams suggests: "Elimination of the Steffen's House process and marketing the molasses directly."

Methods of Waste Disposal at the Blissfield Sugar Factory

The flume and process waters are not sufficiently screened and settled. It has been the practice to pass a part of the process water through a 24-mesh revolving screen and discharge the combined flume and process wastes to the river during the sugar campaign at the rate of more than 2,000,000 gallons a day.

The lime-cake is conveyed by water to a separate storage pond where the lime settles. The supernatant and surplus liquid drains over into the Steffen's waste pond. Some of the lime is disposed of to the farmers for the hauling. During the 1936 sugar season, the company used some of the process water for conveying the lime to the storage pond. By this method, the process water does not go directly into the river. Impounding allows biological action to take place, with subsequent improvement when finally drained into the river.

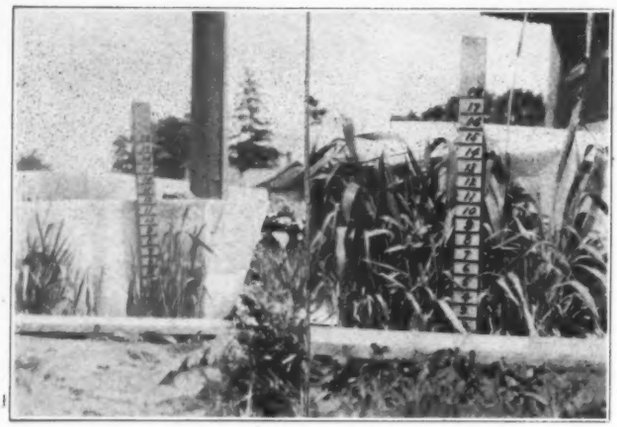
The impounded Steffen's waste is drained into the river at rates varying from 100,000 to 150,000 gallons a day. This is started as soon as the river is free from ice and frequently extends into the late Spring and early Summer months. During the storage period some settling occurs, also considerable fermentation takes place.

From this brief description, it is apparent that the disposal of all the Blissfield sugar factory wastes is ultimately by dilution with the waters of the River Raisin.

Proposed Remedies

If disposal by dilution alone is to be the continued practice, then, all wastes should be thoroughly screened, settled and chemically treated, to remove as much as possible of the suspended and dissolved matter. In addition, certain definite maximum concentrations of these wastes, as determined at some point below where they enter the river, should be set and not exceeded except under rather drastic penalty.

A complete disposal plant has been suggested for treatment of all the sugar factory wastes. The minimum cost of such a plant is estimated at about $50,000. The annual overhead and operating expense would probably exceed $6,000. This method of disposal would be



40-Day Barley Growth Test. Left: Only Water Applied—100,000 *Gal./Acre/Day. Right: Waste Liquor Applied*—100,000 *Gal./Acre/Day.*

quite expensive when one considers that the only wastes that show any possibilities of commercial value are the lime cake and the Steffen's waste.

The lime cake, if handled with a screw or belt conveyor to keep it as dry as possible, might have sufficient value to pay the cost of handling if the semi-dry material were disposed of to farmers within easy hauling distance.

Treatment of the Steffen's waste for recovery of its fertilizer value has been suggested. It has been estimated by Goldman[1], that the Steffen's waste from 100,000 tons of sugar beets contains 106.6 tons of nitrogen, 303.4 tons of potash and 1,000 tons of organic matter. By utilization of the waste heat at a sugar factory, the volume of the Steffen's waste could be reduced about 50 per cent. Spray drying to a powder form, with additional heat, will give a product containing 2.59 per cent nitrogen and 7 per cent potash that should have commercial value as a fertilizer material.

However, many difficulties are encountered in spray drying. Several years ago, when the prices of war ordnance materials were exceedingly high, drying the Steffen's waste to a powder form was practiced at Blissfield, but was discontinued at the end of the World War, when low prices made it unprofitable. Unless a very cheap method of dewatering is found, it is doubtful if evaporating the Steffen's waste to the point of producing the solids in a dry powder form will ever be economically feasible.

Since Steffen's waste has such an appreciable nitrogen and potash content it might be possible to apply the entire volume of this waste directly to the land and, by slow percolation through the soil, deposit the fertilizer material for crop utilization.

A very commonly used commercial fertilizer is one containing 2 per cent nitrogen, 12 per cent acid phosphate, and 6 per cent potash, or formula 2-12-6. For a crop like sugar beets about 500 pounds per acre is used. This would give 10 pounds of nitrogen and 30 pounds of potash per acre. Using these quantities and Goldman's figures rounded to 100 tons of nitrogen and 300 tons of potash produced by the Steffen's waste from 100,000 tons of sugar beets, there appears to be sufficient nitrogen and potash to fertilize 20,000 acres. Stating this another way, if a farmer were to apply Steffen's waste at the rate of 500 gallons per acre he would be applying nitrogen and potash at the same rate as 500 pounds per acre of a commercial fertilizer of the above formula.

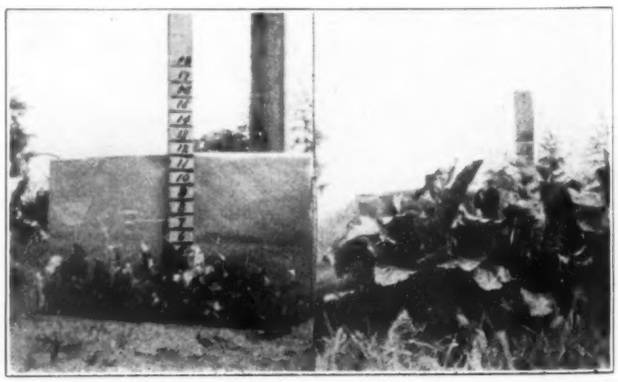
Cropping Experiments

To test the crop growing qualities of raw Steffen's waste, a fifty gallon sample of the liquid draining from the waste storage pond was obtained on May 20, 1935. This sample showed a bi-carbonate alkalinity of 3,690 p.p.m. and zero normal carbonate alkalinity. This solution applied to soil would, of course, impart to it a high alkalinity. In turn, the highly alkaline soil would best support crops that are tolerant of an alkaline soil, such as barley, alfalfa, millet, sorghum, sugar beet, sweet clover, timothy and others. Wheat and many other crops prefer a slightly acid to acid soil.

Tests were first made on flower-pot scale using Michigan blow-sand as the test soil. Wheat and barley were selected. As might be expected, the wheat reacted poorly with the Steffen's waste. The barley, however, appeared to benefit until the Steffen's waste became exhausted and the plants became crowded for growing space. In the meantime, three larger plots were started. These plots were approximately two feet square and were limited to this size because of the amount of Steffen's waste available.

Plots 1 and 2 were dosed with Steffen's waste at the rate of 100,000 gallons per acre or 2.3 gallons per square foot. Control plot 3 was dosed with a similar amount of tap water only. This dosage rate approximates the daily amount of Steffen's waste produced by a 1,000 ton per day sugar plant and might be taken as a basis for computing the acreage required to take care of all the Steffen's waste from any given factory. Again using Goldman's figures, the dosage on plots 1 and 2 would contain 200 times as much nitrogen and potash fertilizing material as would a 2-12-6 fertilizer sown at the rate of 500 pounds per acre.

The test soil was again Michigan blow-sand and the crops selected, and planted in rows six inches apart, were timothy, alfalfa, barley and sugar beets. In each of the three plots, the timothy, after germinating, burned as did also the alfalfa in plot 1. The various plots received the usual rainfall and were given occasional waterings with tap water. The striking difference between treatment and non-treatment of the soil with Steffen's waste is shown in the pictures of the barley and beets taken forty days after planting. The beets in each plot (duplicate test plots and one control plot) were allowed to grow one hundred and twenty days, when they were pulled up, cleaned and weighed. Weighings were first made of the total growth including the leaves, and then trimmed and the roots only reweighed. The total growth exceeded the control by 238 per cent; the trimmed beets from the test plot exceeded the control by 344 per cent —to show quite conclusively the merits of Steffen's



40-Day Beet Growth Test. Left: Only Water Applied—100,000 *Gal./Acre/Day. Right: Waste Liquor Applied*—100,000 *Gal./Acre/Day. (Weight Increase of Roots Alone,* 344 *Per Cent.)*

waste as a growing stimulant for a crop such as sugar beets.

These results should be considered preliminary only, because of the small scale upon which the tests were conducted, but fortunately point to a possible disposal of the Steffen's waste that may prove profitable agriculturally. Transportation of this waste to the land either by direct hauling or piping, would be the major problem in this method of disposal. Considerable experimental work may be required to determine the kinds of crops, kinds of soil, underdrainage, effect on the rotation of crops, methods and times best suited to the application of the Steffen's waste. A vigorous campaign of educating the farmer to the uses and benefits of this waste might well be sponsored by the sugar interests.

Other Waste Disposal Studies

Another method of disposal for the elimination or reduction of objectionable tastes and odors from the Steffen's waste, which affect the Dundee Water Plant, is being tried out by the Blissfield Sugar Company. It has been observed for the past few years that the Steffen's waste discharged to the river during the latter period of pond drainage, that is, along in May, June and July, has a very much reduced BOD. value, indicating considerable fermentation and stabilization has taken place in the ponds during the warmer months. The BOD. curve sheet for the 1935 Steffen's waste drainage period shows this trend. (Curve Sheet No. 3.)

The Sugar Company, during the 1936 Steffen's House run, carbonated the waste immediately at the point of entrance into the storage pond. The pH value was reduced to 7.6 to 7.8 at which point biological action started at once and continued during our unusually mild Winter, with the result that the BOD. has been reduced to about 120 as compared to 1,200 or 1,500 at this time (March 1st) in previous years. The Company further proposes to allow the Steffen's waste to remain in a reservoir of about 40 acres during the first Summer and then drain it into a second reservoir to 'age" for another year, and thereafter into the river. Chlorination of the residual waste as it drains to the river improves it further as indicated by a few preliminary chlorination tests. It is hoped that this 18 to 24-month storage, especially over the two Summer periods, will sufficiently stabilize the waste so that it will give very little trouble in water treatment at the Dundee Filtration plant. Also that it will have minimum effect on fish life in the river.

Conclusions

Some promise of success is shown in the disposal of Steffen's waste by at least three methods, namely:

1. **Evaporation to dryness:** This method may prove costly because of mechanical difficulties and the extra fuel required to evaporate the 40 to 50 per cent that cannot be so treated by the waste heat from the regular sugar plant processes. However, a marketable product, potash, is obtained.

2. **Direct application of Steffen's Waste to land under cultivation:** This method may prove prohibitive because of transportation costs, but this cost would be offset in part by larger crop production. Both methods 1 and 2 would remove the Steffen's waste from drainage into the river and thus entirely eliminate this source of pollution.

3. **Biological action and stabilization:** This method of treating the Steffen's waste over a longer period of time is probably the cheapest. It involves the purchase only of additional land for impounding purposes. The final product will be drained into the river with some pollution effect and with the loss of any fertilizer material which the first two methods propose to utilize. The success of this third method will depend upon the degree to which the stabilization proceeds.

A combination of some part, or all, of the three above methods might prove practicable:

(a) Evaporate to dryness the 50 per cent of the Steffen's waste for which there is now waste heat available.

(b) Transport a portion of the remaining waste to nearby farm land.

(c) Biological stabilization of the recarbonated excess waste by long storage in reservoirs. Oxidation of the final waste, by chlorine application, during discharge to the river.

REFERENCES

[1]Bulletin No. 31, Michigan Engineering Experiment Station, Michigan State College, East Lansing, Mich., "Studies on the Treatment of Beet Sugar Factory Wastes," Report No. 1, by E. F. Eldridge and F. R. Theroux.

[2]Second Biennial Report (1933-1934) of the Michigan Stream Control Commission, Lansing, Mich.

[3]Correspondence and conversations with Mr. E. E. Stiff, General Suuerintendent, and Mr. W. E. Weller, Superintendent, Great Lakes Sugar Company, Blissfield, Mich.

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Elected Officers Central States Section

E. C. Trax
Chairman

E. P. Johnson
Sec'y-Treas.

H. L. Nelson
Nat'l Director

At its 39th Annual Convention held in Dearborn, Mich., August 18th to 20th, the Central States Section of A.W.W.A. elected as its new chairman, Edward C. Trax, Supt. of Filtration, McKeesport, Pa.; as its member of the Board of Directors of A.W.W.A., H. Lloyd Nelson, District Manager, U. S. Pipe and Foundry Co., Pittsburgh, Pa.

Mr. Trax has long been a "wheel-horse" member of the Section and is a past Chairman of the Pennsylvania Water Works Operators' Association. Mr. Nelson has served the Central States Section as its energizing secretary for several years and is highly deserving of the honor of having been selected to represent his Section on A.W.W.A.'s Board of Direction. His experience in Section affairs will prove a particular asset in his work as director. Mr. Nelson will take office during the 1938 Convention at New Orleans, succeeding Prof. Lewis V. Carpenter who has been performing yeoman service for A.W.W.A. during his term as a director.

As Secretary-Treasurer of the Section, was elected Earl P. Johnson, District Manager, Wallace and Tiernan Company, Pittsburgh, Pa.; as Section Trustee, the retiring Chairman Roberts Hulbert, Chemist, Detroit Water Department.

WATER PURIFICATION DIVISION HAS VARIETY OF TECHNICAL PAPERS AT BUFFALO CONVENTION OF A.W.W.A.

By HARRY A. FABER

*Associate Editor**

SESSIONS of the Water Purification Division at the A.W.W.A. convention in Buffalo, attended to capacity, were evidence of the fact that an impressive proportion of the members are vitally interested in new developments and problems of water treatment. The well-rounded program presented under C. J. Lauter, Chairman of the Division, and arranged by Chas. R. Cox, Secretary, thoroughly justified the attendance. Features of the program were: a panel discussion of gastro-enteritis, a symposium on water softening, committee reports, and technical papers of timely importance.

Election of Officers

Officers to serve for the term 1937-1938 were elected. They are: William W. Wallace, Chairman; Charles G. Hyde, Vice Chairman; Chas. R. Cox, Secretary-Treasurer; and C. J. Lauter, Paul Weir, Chas. H. Spaulding as members of the executive committee.

Two Committees Report Progress

"Committee on Chlorine Ammonia Treatment"—F. WELLINGTON GILCREAS, Chairman, State Dept. of Health, Albany, N. Y.

The increasing use of this method of water disinfection, and the problems which have accompanied its adoption, have warranted the study of both fundamental and practical considerations involved. Only recently organized, the study of the members will be applied to laboratory and plant results. Data concerning the formation of chloramines, and the comparative efficiency of chlorine and chlorine-ammonia in disinfection as well as a bibliography of the subject are now under way. Members of the committee will accumulate data from plants where this treatment is employed for a study of results obtained and problems involved. A more comprehensive report is planned by the committee for the 1938 meeting.

"Committee on Determination of Fluorides"—A. P. BLACK, Chairman, Prof. of Chemistry, Univ. of Florida, Gainesville, Fla.

*Research Chemist, The Chlorine Institute, New York City.

Carl J. Lauter
(Washington)
Chairman 1936-'37

Wm. W. Wallace
(Detroit)
Chairman 1937-'38

Methods so far proposed for fluoride determination are being investigated in eight laboratories where water samples of widely different chemical characteristics have been examined. A first report of 32 mimeographed pages has been issued, a second is in preparation, and a 50-page bibliography has been completed. After critical review on the basis of individual analyses, a standard method of fluoride determination will be adopted and comparative results on a standard fluoride sample will be reported, employing the method. The indications of work reported to date are: that the U. S. Bureau of Standards method is not satisfactory; that ferric iron interferes with the Sanchis method; that the Sanchis method appears to give higher results than the distillation procedure.

Papers on Water Conditioning

"A Survey of the Condition of Rapid Sand Filter Beds in Illinois"—By C. W. KLASSEN, Chief Sanitary Engineer, State Dept. of Public Health, Springfield, Ill.

The State of Illinois has 614 municipal water supplies, of which 95 operate rapid sand filter plants. To give plant operators an index of proper filter function and of effluent quality, the field engineers of the Public Health Department have made a survey of filter sand condition. The method developed by J. R. Baylis, and reported in WATER WORKS AND SEWERAGE, Sept., 1935, pages 326-330, is used. By this method the per cent by volume of mudballs in the top six inches of filter sand is determined using a sampling cylinder and taking four samples from each bed. The mudballs are separated from the sand, using a 10-mesh screen, and the volume is measured by displacement. Standards of quality have been adopted: if only 0.1% or less of material is retained by the screen, excellent; if up to 0.2%, very good; and if 5% is retained the rating is very bad.

Data have so far been collected from 40 rapid sand filter plants, representing all types of filters, and show that pre-chlorination and washing aids are important in maintaining filter condition. Valuable preliminary conclusions drawn from the survey show a definite relation between the appearance of the filter and the condition as indicated by the mud-ball test. Where there is no cracking or drawing-away of the surface sand there will be a low mud-ball rating. Good coagulation is reflected by good filter sand condition and in newer plants operating under capacity (hence long mixing and coagulation time) this is particularly apparent.

In plants where good filter conditions obtain, the washing rate is at least 15 gal. per sq. ft. per minute, with the exception of only three plants and in these same auxiliary washing aid is used. Prechlorination is credited with compensating for coagulation or washing deficiencies. Several plants have adopted the mud-ball test as routine practice and find it an aid in maintaining plant efficiency. Mr. Klassen's paper evoked considerable discussion from a variety of operators.

Prof. Chas. G. Hyde
(Berkeley, Calif.)
Vice Chairman

Chas. R. Cox
(Albany, N. Y.)
Secretary-Treasurer

John R. Baylis, who developed the mud-ball test, felt gratified that the published method was proving of value. He cited experiments to show that coagulation and sedimentation had a very marked effect on mudball formation; after good coagulation, water applied to filters immediately produced 27% mudballs; when settled 2 hours only 7% mudballs; and when settling was increased to 4 hours, only 3% of mudballs were produced. When filter sand is cracked from the walls much of the water is by-passed unfiltered, and the effluent turbidity test is not very helpful in revealing this condition.

W. M. Wallace, Supt. of Filtration, Detroit, claimed equal attention must be given to conditioning and washing procedure. A definite 50% sand bed expansion was cited as showing best washing results, irrespective of sand size.

A. V. Graff, Supt. of Filtration, St. Louis, described the bad mudball condition produced by applying a coagulated water with a turbidity of only 5 to 6 p.p.m. The mudballs are unevenly distributed and there is no pulling away of surface sand. By washing the top 3 inches of sand with an ejector at least once monthly a water of less than 0.1 p.p.m. turbidity is produced. He scored the application of turbid water to filters. At St. Louis, sand 23 years old is still in service and in good condition.

Mr. Jennings, Chemist, Watertown, N. Y., reported that pre-ammonia chlorine treatment had shown decided advantages at his plant. Pre-chlorine application alone had reacted with sulfite liquor in the raw water, but the ammonia chlorine method produced no such taste. The sand under such treatment had improved to the point where it now has the appearance of new sand.

N. J. Howard, Supt. of Filtration, Toronto, reviewed the many developments in washing methods since 1920. These studies, he indicated, were probably made from the wrong end of the problem—because with proper preconditioning subsequent difficulties would not occur. This view is receiving growing recognition and experience shows that special washing facilities are, as a rule, unnecessary with proper coagulation and operation. Larger size of filter media, with slightly greater depth, is giving better results at less cost for wash water.

H. G. Turner, Director of Research, Anthracite Institute, added that relatively coarse filter media was proving less susceptible to mudball formation than the finer media. In his opinion it was preferable to lose a little sand and have a clean filter than to lose no sand and have a dirty filter.

W. C. Lawrence, Supt., Baldwin Filtration Plant, Cleveland, said one plant in his city has trouble with mudballs and one has none. Conditioning of water and sand expansion in washing both seem important reasons. That plant having 50% sand expansion had no mudball troubles, and has shown only a two-inch sand loss in 12 years of operation.

S. T. Powell, Consulting Engineer, Baltimore, also stressed effective raw water conditioning and proper plant design to eliminate mudballs rather than dependence upon washing aids.

"Silicates as Aids to Coagulation"—By John R. Baylis, Physical Chemist, Bureau of Engineering, Chicago, Ill.

Experimental work on laboratory and pilot plant scale has shown that silicates, by producing more rapid coagulation and floc of larger particle size, will give more rapid and better sedimentation. It appears that, because certain waters either lack silica or contain the wrong form of silica, results well justify the cost of adding this material. Chemical analysis will not show response of water to coagulants, since many waters will coagulate readily over a wide range of pH (5.5 to 7.5), while others will not do so.

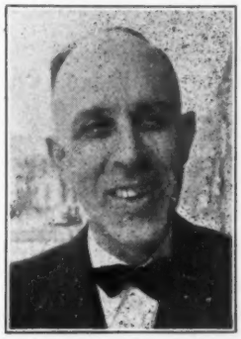
Prepared or "synthetic" waters, containing various salts in solution were studied and for the most part showed marked differences in coagulation, as compared with Lake Michigan water. The silicon effect was found in studying this difference. That a compound of colloidal hydous silica dioxide, possessing a negative electric charge, gives best results in floc formation with aluminum hydroxide has been definitely shown. The three articles, describing the use of silica to aid coagulation, which have appeared in Water Works and Sewerage, were referred to by Mr. Baylis.

In one is described the method used to prepare acid sodium silicate solutions for use with alum as the coagulant.

Mr. Baylis reported that iron coagulants were also aided by such solutions, but the investigation of these has not yet been completed. Using alum and silicate solutions, floc particles as large as 0.5 inch across may be produced in plant operations, presenting a spectacular appearance in the settling basin, and greatly increasing the settling rate. Because the acid-treated silicate solutions must be used within 2 to 3 days after preparation this may explain why silicates naturally present in the water may not give much aid to coagulation. Tests, so far carried out, indicate that there is no increase in the silicate content of the water after filtration—though this would be possible if improper coagulation is permitted.

Prof. A. P. Black, in discussing the paper, complimented the author on the careful observation which has developed a promising new field of research concerning the effect of small amounts of substances on coagulation. While copperas (ferrous sulphate) may be floc-

Paul V. Weir
(Atlanta)
Dir. Executive Com.



Chas. H. Spaulding
(Springfield, Ill.)
Dir. Executive Com.

culated at very low pH values, it is generally necessary to use lime for higher pH and best results. Since oxidation occurs with the loss of an electron, and ferric hydroxide easily loses an electron, the existence of insoluble iron silicate as a transitory compound may explain the ease of oxidizing ferrous silicate.

On the acid side of neutrality both alum and iron bear a positive charge. In coagulation with iron salts, in the neutral zone the ferric floc changes the charge from positive to negative. This knowledge of electronic charges and the effect on coagulation means that water chemists can learn much from the colloidal chemistry involved.

S. T. Powell admitted the findings reported may be of far-reaching importance, but that the result would not be a cure-all. The complex relationships in the reactions are little understood and caution in adopting the method was advised by Baylis. Under present-day conditions of boiler operation, the least amount of silica is objectionable. There are several processes for removal of this substance, since scale forms in the absence of calcium and magnesium, largely a sodium and aluminum complex. Such scale, even as low as 0.01 inch in thickness is dangerous.

High operation and maintenance costs are introduced and imbrittlement of steel may result. He contended that some recognition of industrial problems must be given by municipal plants. Until more quantitative data are available, he advised against the carrying of even a few parts per million of silica in treated water.

O. M. Smith, Prof. of Chemistry, A. & M. College, Stillwater, Oklahoma, noted that much was still to be learned from a colloidal viewpoint and that previous work had shown aluminum to react with silica to form an adsorptive compound. He cited several instances indicating that the condition of silica, carried naturally by water, affected coagulation. Oklahoma river waters carrying siliceous soil are easier to coagulate as the river rises. Two plants in the state have reported marked changes in the type of floc produced during a low water supply—the reason for which might have been shown by silica analyses. In these cases the fibrous character of the floc was destroyed when prechlorination of the supply was stopped, and the addition of a prechlorination dose returned the desired floc characteristics.

"The Dynamics of Sedimentation" — By J. J. Slade, Assoc. Prof. of Eng. Mechanics, Rutgers University, New Brunswick, N. J.

Basing his discussion on the "fundamental principle of mechanics that a particle of matter cannot change its velocity in a given direction unless it receives an impulse in that direction," Professor Slade has developed a mathematical method of analyzing sedimentation. According to the method described, the "distribution function" accounts for the settling velocities in an unsettled suspension. Since turbulent velocity can be measured with precision, and since this is the single quantity which must be considered, it can be correlated with tank dimensions and the sedimentation characteristics of any material may be determined.

So highly technical was the data presented in the paper that no open discussion followed its presentation, but a prepared discussion by Prof. L. V. Carpenter (New York University) supplied thorough criticism.

Prof. Carpenter emphasized that the multiplicity of factors affecting sedimentation makes it a very difficult problem to analyze mathematically. In the design of a sedimentation basin, there are three problems: the shape, size, and characteristics of the basin itself; the physical characteristics of the flocculent material; and the prediction of performance. All the analysis presented is contingent upon the turbulent energy being uniformly distributed throughout the basin; further, that no marked stratification occurs. It will be very difficult, however, to express the effect of coagulation mathematically, since the sanitary engineer deals with sediment that coagulates and changes its hydraulic properties during the settling process. A fragile floc has value in sedimentation, but is very difficult to measure. He indicated that the paper adds much to our fundamental knowledge of sedimentation and that material of practical value might be developed from the start Professor Slade has made.

Prof. A. P. Black
Univ. of Florida

C. W. Klassen
Springfield, Ill.

Symposium on Water Softening

"Review of Lime-Soda Softening"—By Charles P. Hoover, Supt. of Purification, Columbus, Ohio.

Mr. Hoover recounted the historical developments in water softening, after which the more recent practices were discussed in some detail.

Over-treatment with lime and neutralization with caustic soda is satisfactory for industrial, but not for domestic purposes. Split treatment is not now as advantageous as formerly, because recarbonation is practiced. Experience at Columbus has shown that recarbonation, to convert the calcium and magnesium carbonates to bicarbonates, results in incrustation of sand and deposits in the system. Most of this incrustation takes place in the filters, however, and it is more economical to replace sand than to sacrifice softening.

Several of the present problems in connection with softening were noted and commented upon. Attempts in the direction of removal of colloidal precipitates ahead of filters leaves much to be desired. Calcium carbonate addition will do this, but the addition of lime sludge has shown little success. Experiments with the International Filter Company's "Super Settler" may be of value. Since alkalinity and pH may now be maintained at almost any desired value, it is of high importance to determine what the pH of lime-softened water should be to make it least corrosive and, at the same time, least deposit forming.

"The Conditioning of Water Softening Precipitates"—By Charles H. Spaulding, Supt. of Purification, Springfield, Ill.

Mr. Spaulding described a unique method of sedimentation which has been developed from a laboratory experiment to full plant scale. With such a settling device, a much higher filtration rate may be obtained, and in some cases turbidity may be so reduced that subsequent filtration is unnecessary. The device as used is based upon two principles: that the precipitation of a saturated solution (in lime-soda softening) must be accomplished by bringing into intimate contact the soluble and solid phases, and that stirring of a precipitate

before filtration will increase the floc size. The "precipitator" finally devised applies both of these principles.

Return of settled sludge gives poor results because of the fine floc. The Springfield method allows no sludge to settle and employs an upward flow contact-precipitator, shaped like a funnel. Rapid mixing is supplied ahead of the funnel and floating sand, which becomes coated with calcium carbonate, is used for contact material. Much shorter detention times are required and, on plant scale, comparative results have shown one hour to give results superior to 8 to 10 hours in conventional settling basins. In sizes above 1 m.g.d. rate the original funnel shape would become prohibitive in area, so the design has been modified to employ a cone inverted to act as the entrance to the larger cone area.

Mixing is carried on for 30 minutes and sedimentation for only 60 minutes. The sludge concentrator has draw-offs for two effluents, clear water and sludge; only 1 to 2 per cent of unthickened sludge is obtained. Mr. Spaulding presented a summary of results to show the highly advantageous performance obtained with such a conditioner in actual plant use. The unusual design warrants close study of this paper upon publication.

"Review of Zeolite Water Softening"—By Shepard T. Powell, Cons. Chem. Engr., Baltimore, Md.

Citing his review as largely statistical in nature, Mr. Powell said that up to 1929 not more than 100 softening plants had been installed and over 30 per cent of these were in Ohio. All the earlier zeolite plants were installed for industrial use, and only eight years ago did municipal installations begin. In 1937 the aggregate capacity of municipal zeolite installations is 19 m.g.d. In choosing the type of softening which should be adopted for a particular water supply, eight important considerations were mentioned, including: the relative cost of chemicals, the presence of organic matter and turbidity, and pumping costs.

According to Mr. Powell, a water to be acceptable, should have less than 6 grains per gallon of hardness forming materials, but if water is completely softened it becomes corrosive. The natural zeolites have softening capacities of about 2,800 grains per cubic foot, while the same amount of synthetic zeolite will remove about 8,000 to 1,200 grains of hardness between regenerations. Because less equipment and attention are required, the synthetic zeolite is more popular for municipal installations. Due to brine recovery systems now in use, the consumption of salt—most important as an operating cost—has been reduced to as little as 0.35 pounds per 1,000 grains of hardness. The more recent softening units are controlled like filter units; some are largely automatic in operation. The cost of such systems varies widely, but compares with other types of softening. For seven municipal plants (inclusive of coagulation and filtration) the fixed costs average $90,000 per million gallons of plant capacity.

Chas. P. Hoover (Columbus)

Norman J. Howard (Toronto)

S. B. Applebaum (Permutit Co.) discussed the paper by Mr. Powell, saying that, in his opinion, the absence of sludge in water softening by the zeolite process is a most advantageous factor. The two types of zeolites mentioned are the most widely used, but in addition a newer zeolite is coming into use. It is carbonaceous in nature, has a high capacity, is resistant to attack and is regenerated by sulphuric acid. The bicarbonates of calcium and magnesium are converted to carbonic acid in this case, and removed by an aeration process.

A. S. Behrman (International Filter Company) complimented Mr. Hoover as an authority in the field of softening. He summarized the conditioning method of Spaulding as employing, in a beneficial manner, the old idea of contact between coagulated water and solid material. The trend toward more economical operation of zeolite softeners, he said, is important. The life of zeolites can be better rated by the amount of softening accomplished, and better factors of safety are now employed.

Edgar W. Johnson (Sr. Engr., Minneapolis Water Dept.) described the proposed softening of 120 m.g.d. for Minneapolis water supply. A temporary plant (40,000 g.p.d.), in which the lime-soda process is employed, is being used for study. The Mississippi River water shows considerable variation with seasonal changes, and this type of softening, preceding alum coagulation, made color removal difficult. Experimental operation of the plant over a three-year period has shown that a good color removal and freedom from taste and odor troubles are accomplished by reversal of the process; softening following alum addition. Iron sulphate and lime produce an excellent floc in cold weather when alum is least efficient.

Concern Over Gastro-Enteritis Problem

The increase in reported cases of gastro-enteritis made the panel discussion on this subject most timely. Because of the inadequacy of available reliable data, a program of papers on the same subject is planned for the 1938 meeting of this division. Discussions at this meeting were given from notes rather than from prepared papers.

Chas. R. Cox opened the discussion with a brief review of studies conducted in New York State. Obscure outbreaks, he said, must be more completely traced by public health officials. It does appear that water supplies are implicated in many cases but, because our usual methods of analysis yield little conclusive data, the matter of proof becomes very difficult. As illustration of possible causes under suspicion, he cited the decomposition of algae and of prolific crenothrix growths. Many supplies believed to have caused gastro-enteric disturbances were practically free from bacterial pollution, but did show the presence of anaerobes not ordinarily tested for. Complete studies should be made during the period of incidence of such conditions.

Cited as a typical outbreak was a very recent incident near Albany (Altamont, N. Y.) which was studied in a comprehensive fashion. Out of a population of 1,000 persons, 680 were interviewed, and about 125 who did not use the municipal supply were not affected. The remainder showed typical symptoms of gastro-enteritis, persisting for 48 hours to one week. Laboratory examination of the rapid sand filtered water supply, which is chlorinated to the point of effective coli destruction, gave no evidence. There is, however, no assurance that the chlorination process was uninterrupted. Neither did fecal specimens show any typical organism.

The raw water is from a mountain source and is not subject to sewage pollution; post chlorination to give a residual of 0.05 to 0.1 p.p.m. with long contact (storage for 3 days after treatment; but a sudden rise in chlorine demand which was not met by increase in dose is possible. The reservoir has concrete walls and is open but chemical and microscopic examinations showed only slight increase in oxygen demand, no algae growths. Unusual is the rather high (1.3 p.p.m.) chlorine demand required to give 0.2 p.p.m. residual in the supply. It was felt that even with rapid study and survey of the situation, the information gathered did not tell the whole story.

J. J. HINMAN, JR. (Univ. of Iowa) presented the second discussion, reviewing the developments of typhoid fever prevention methods and suggesting new technique for new diseases. Specific tests should be developed for other organisms than the usual coli- aerogenes group, the detection of streptococcus types should be stressed, and slow lactose-fermenters should be studied, were his proposals.

A. E. BERRY described in detail two outbreaks of gastro-enteritis in Ontario, and questioned actual bacterial influence. Chemical irritants were suggested as a possible cause, since the decomposition of an abundant growth of lake anabaena was believed to have been the cause of the death of twenty animals drinking the water. The Ontario Health Department is intensively investigating such situations this summer.

DR. N. R. ZIEGLER (Dept. of Bact. and Prev. Medicine, University of Missouri) reported that "late lactose fermenting" bacteria have been isolated from the blood and stools of affected persons. The question of pathogenicity of non-lactose fermenting and of lactose fermenting but non-gas producing organisms was discussed. At Springfield, Mo., in an epidemic of dysentery and typhoid (dysentery 20 to 35 thousand cases, typhoid 197 cases and 25 deaths) the dysentery incidence had persisted longer. When residual chlorine was reduced in the city supply from 0.35 to 0.2 p.p.m., lactose fermenters and diarrhea again increased. With increase in chlorine residual, the diarrhea apparently ceased. The origin of the dysentery was believed to be in the late-lactose fermenting (54 to 96 hours or even 10 days) organisms which were related to colon bacilli or were in themselves pathogenic. He believes a chlorine residual of 0.2 p.p.m. to be too low—that higher residuals or super and de-chlorination may be required to insure absolute safety in disinfection.

DR. LELAND W. PARR (George Washington Univ., Washington, D. C.) stressed the desirability of following even more closely Standard Methods of Analysis, with direct innoculation of samples in the field as a preferred measure. With regard to bacteria as the causative factor, he cited the possibility that chlorine, in low doses, might shock but not kill organisms—particularly in water having a high chlorine demand. Such organisms might, also, vary in resistance with environmental factors. If chemical irritants are accepted as the cause of gastro-enteritis, what of the many bacteria isolated from affected persons? Various illnesses, he said, produce a change in the normal flora of the body. It is possible that toxins may be more than ordinarily potent—or more may be produced in dry years. Almost no bacteriologists have studied the bacteroides (anaerobes)—most numerous of the normal intestinal inhabitants—which he mentioned as a potential cause of the disease.

DR. FRANK E. HALE (New York City) expressed his hope, from a practical standpoint, that higher residual chlorine would not be found necessary. New York City maintains a low residual, but meets all variations in chlorine demand, and employs multiple chlorination, to keep that residual at all times. With adequate contact time, he believes even the more resistant types are killed with low chlorine doses.

E. S. Chase
(Boston)

W. F. Gilcreas
(Albany)

GEORGE D. NORCOM (Federal Water Service Co.) advised the accumulation of more data on the raw water supply, saying that knowledge of the quality of the finished water was insufficient. The failure of purification processes and the difficulty of sterilization when water is high in organic content were cited as weak points in water treatment. Mr. Norcom criticized the Minneapolis study of chlorine and chloramine sterilization by noting that the concentration of organisms used (8,000 to 85,000 per 100 cc.) was widely outside the limits set up by Streeter even for those waters requiring both filtration and chlorination. He claimed much additional evidence is necessary before doubt should be cast on the adequacy of the Standard Methods of Analysis.

F. H. WARING (Chief Engr. State Dept. Health, Columbus, Ohio) described two recent epidemics in his state. At Coshocton there was no evidence accumulated to prove that the water supply was implicated, and residual chlorine was found at several points on the distribution system. In the city of Mansfield, where a serious typhoid outbreak (140 cases) occurred, evidence points to the water supply, since all but 3 cases were located on the high service distribution system, but no direct proof was found by bacteriological tests. Unless there is very definite proof, Mr. Waring contends that confidence of the public in the municipal water supply should not be destroyed by crediting the supply with being the cause of an epidemic.

DR. JOHN F. NORTON (The Upjohn Co., Kalamazoo, Mich.) drew a rather depressing picture of epidemiologists and medical bacteriologists as failing to be of help in such outbreaks, and of Standard Methods as inadequate to disclose the cause. Specimens analyzed twenty-four hours after sampling could be of no value, he claimed.

C. J. LAUTER read a communication from a Dr. Stone of the Army Medical College in which it was flatly stated that cysts of amoebic dysentery are no more resistant to chlorination than are organisms of the coli type.

Wolman Summarizes the Problem

ABEL WOLMAN (Chief Engineer, Maryland State Health Department, Baltimore) in a very competent fashion summarized the discussions from the viewpoint of the problem and knowledge which had been presented. Epidemiological evidence (which he termed "circumstantial evidence") seems to indicate, he said, that water supplies have been the cause of dysentery

outbreaks. Two attitudes toward the situation are possible: first, a defensive one, to prove it could not be caused by the water supply; second, stressing the lack of evidence, to say the situation may be forgotten. These same attitudes prevailed fifty years ago, and should properly give way to a preparation of defenses in water plants before further cases occur. The "Standard Methods" rest on a sand foundation because, as applied generally, they become more and more specific and less protective of the consumer. The best index of an inferior water supply is the man who died.

The chlorine demand test, Mr. Wolman insisted, has received too little attention. As an important indicator of the change in characteristics of a supply (or something wrong in processing) it has a significance beyond that of an indicator in controlling the chlorine dose. He urged an increased frequency in determining chlorine demand.

Pollution vs. Population

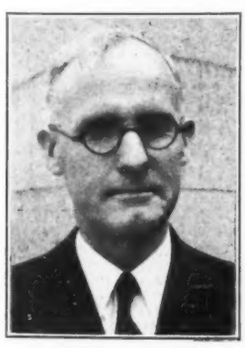
"Correlation of Bacterial Pollution with Watershed Population" by E. Sherman Chase, Cons. Engr., Metcalf and Eddy, Boston, Mass.

This study was an attempt to answer the question "Is there a correlation between B. coli pollution and the population of the contributory watershed?" Using the data supplied by U. S. Public Health Bulletins 143, 171, and 203 (studies of the Ohio, Illinois, and Upper Mississippi Basins) as typical of moderate populations with no large centers of pollution, Mr. Chase selected August, September and October as the months for correlation. He employed the term "cosecs." as obtained by multiplying the number of B. coli per cc. by the cubic feet per second of flow. The range used was 2 to 230 "cosecs." per square mile.

The answer: there is no relation shown between increasing population and cosecs. There is no increase in cosecs. with sewered population. There is no relation shown in plotting total population and cosecs. There is no correlation under winter or summer conditions.

In general, the larger the area, the smaller the number of B. coli at the mouth of the stream. Wide differences are shown by the data in respect to number of B. coli per capita per day, the figures varying from 0.5 million to 175 million. The larger watersheds show lower numbers per capita—dues probably to increased opportunity for self purification of the streams. Mr. Chase proposed further investigation to determine whether the B. coli content of a surface water is a reliable sanitary index or whether the density of population is to be prefered.

S. A. Greeley (Chicago) in subsequent discussion declared that local conditions differ so widely that studies of averages are of little value. Industrial wastes, surface run-off, detention within the system, and the condition of the stream all affect pollution of raw water. The important fact, in his opinion, is the relation between the quality of the water and its effect on population. That is, bacterial numbers is a better index for comparison with death statistics than is the contributory population.



John R. Baylis (Chicago)

Sheppard T. Powell (Baltimore)

Evaluation of Carbons

"Experiences with Taste and Odor Removal at Hammond, Indiana" by J. C. Vaughn, Chemist, Hammond Filtration Plant, Whiting, Indiana.

This study of the relative efficiency of various available activated carbons was necessary since, in June, 1936, before operation of the new Hammond plant it became essential to determine specifications for the material. Preliminary examination indicated that more carbon would be required than any other chemical—some 625,000 pounds at a cost of $25,000. Since the contract was to be awarded to the lowest bidder (prices ranged from $.04 to $.0511 per pound) a definite phenol value guarantee, with a penalty clause, was required.

Mr. Vaughan eloquently described the Lake Michigan pollution problem which, because of prevailing winds, brings industrial waste, sewage and garbage to the plant intake. Accurate control is impossible because of rapidity in variations of pollution load—but operators have been trained to make threshold odor determinations throughout the 24 hour operating period.

To compare the carbons offered by five major manufacturers, a plant test, using one as a reference carbon, has been made. This was based on the parts per million of carbon required to remove 1 threshold odor and comprised some 415 raw water samples, necessitating about 5,000 dilutions and 50,000 calculations. After four months of testing such water samples at Hammond, the phenol value is indicated as the best basis for buying carbon.

Study of the effect on taste and odor removal, brought about by variations in alum, chlorine, and ammonia showed that a voluminous floc (0.6 to 1.0 grains per gallon of alum) gave optimum removal. Poor floc was low in adsorptive ability, but too high an alum dose produced a floc which enveloped the carbon and likewise decreased its adsorptive power. A prechlorination dose of 0.3 p.p.m. with a 3 to 1 chlorine—ammonia ratio proved efficient. Over the 4 month period of the study the carbon dose required varied as follows:

40%	of time	40	to 100	p.p.m. dose
50%	of time	100	to 250	p.p.m. dose
5%	of time	150	to 300	p.p.m. dose
5%	of time	300	to 347	p.p.m. dose

Results of the test were summarized on the basis of knowledge acquired at the Hammond plant. For this supply, the phenol test accurately compares carbon efficiency. No fixed relation was found between the physical properties of the carbon and the taste and odor removal accomplished. In every test no carbon showed particular selectivity as compared with the reference carbon. The relative removal efficiency increased as taste and odor intensity increased. Action is rapid, as 60 per cent of the taste and odor are removed at the end of the mixing period.

George D. Norcom described a similar removal problem at Chester, Pa., where aeration and the use of bleaching-clay had been utilized to good advantage. The possibility of distant intake location was noted.

M. M. Braidech (Case School of Applied Science, Cleveland, Ohio), as chairman of the Committee on Activated Carbon Specifications and Tests, reported encouraging results from field users and manufacturers. He requested further appraisal of the different test

Prof. Jack J. Hinman, University of Iowa

A. S. Behrman Chrm. Director Inter. Filter Co., Chicago

items and the preparation of a standard reference sample of activated carbon for distribution. By vote of the Division, the work and personnel of the Carbon Committee was continued.

"A Simplified Method of Iron and Manganese Removal"—By D. L. Erickson, City Engineer, Lincoln, Nebraska, and N. T. Veatch, Jr., Cons. Engr., Kansas City, Mo.

The water supply for the city of Lincoln is obtained from a series of wells equipped with individual pumps and delivering to a common main. The treatment plant is at Ashland and water is again pumped to Lincoln. Raw water contains 0.25 to 1.25 p.p.m. manganese and 0.3 to 0.6 p.p.pm. iron which is not only objectionable from the color produced, but which leaves deposits in pipe lines.

Operation of a pilot plant over an 18 month period showed adequate removal could be obtained by employing prechlorination, aeration, chlorination, cake contact filters with upward flow, two hour sedimentation, and final filtration at a 4 gal. per sq. ft. per min. rate. Unless 0.5 p.p.m. chlorine residual is maintained, crenothrix growths will occur in the pipe lines.

The final plant as built requires continuous prechlorination at the wells and at from 1 to 4 points in the system, which maintains the lines free from crenothrix. The upward flow coke-filters operate at 8 gal. per sq. ft. per min. and four rapid sand filters are required to produce the necessary 12 m.g.d supply. During early operation of the plant only 40 per cent of the manganese was removed, but, with the addition of chlorine between aeration and the contact filters, a 95 per cent removal is being obtained. The final plant effluent contains only 0.04 p.p.m. manganese and 0.02 p.p.m. of iron.

Filter runs have been increased from 100 hours during the first 6 months of operation to 140 hours, the second 6 months, and after 18 months to 150 hours. A 24-inch wash water rise is employed. Sand on the final filters becomes black in color and operation is aided by draining filters to dryness before washing. Manganese removal by the various steps of the process is given as: 25 per cent in contact filters, 15 per cent in the covered sedimentation basins, and 45 per cent in the final sand filters. Such operation has been shown, after 18 months of actual use, to be an entirely feasible process.

J. R. Baylis, noting the unusual difference in manganese content of the wells, said such a preliminary study by means of an experimental plant is always the best approach to a problem. The low cost of operation which has resulted certainly justifies the process adopted.

"The Use of 'Anthrafilt' in a Slow Sand Filter with a Blaisdell Washer" by A. C. Bailey, Civil Engineer, Eastman Kodak Co., Rochester, N. Y.

Electrically driven sand cleaners are employed in cleaning slow sand filters treating industrial water at this plant. Suction is applied 2 inches above the sand and teeth penetrate 8 inches into the surface. The sand has an effective size of only 0.18 mm. and no coagulant is employed. The top 4 inches of sand on one filter bed were replaced with Anthrafilt, 0.4 to 0.5 mm. in size. Since each grain of this material weighs approximately one-half as much as sand, particles twice as large may be used and the surface layer acts as a roughing filter.

Careful examinations were made to determine whether Anthrafilt and sand would mix, whether washing would remove the Anthrafilt, whether washing would be efficiently performed and the standards of removal would be maintained. After two weeks of operation, considerable mixing of the filter media had occurred—to a maximum depth of 11 inches—but a greater washing depth was obtained. During the test the Anthrafilt bed had to be washed only one-third as frequently as the sand bed. Raw water turbidity was reported as varying from 150 to 200 p.p.m. while that of the effluent was maintained at 2 to 3 p.p.m. The effluent of the Anthrafilt bed showed better removal of organic matter and color.

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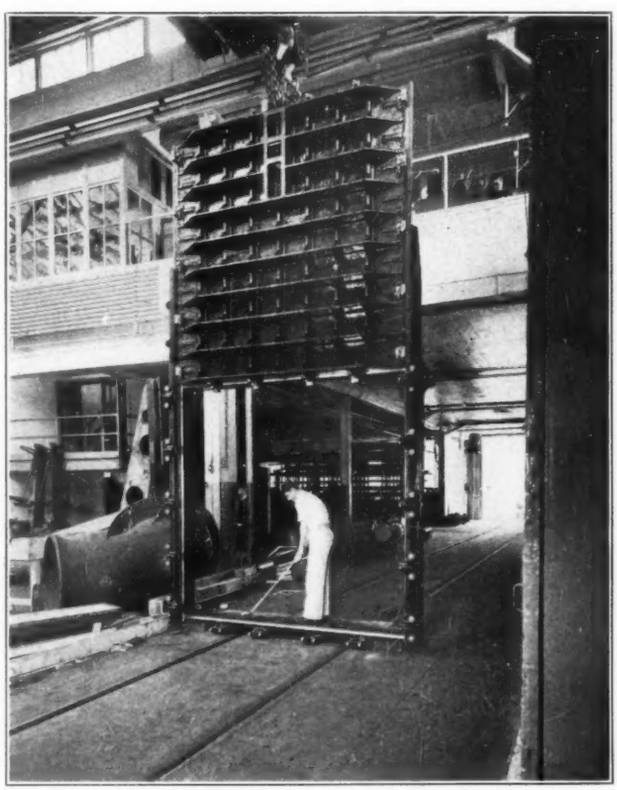
No "Watch Charm"

The illustration pictures one of thirty motor-driven sluice gates being fabricated for the new Buffalo, N. Y., Sewage Treatment Plant. This one is 9 feet square



Sluice Gate for New Buffalo Sewage Treatment Plant

—the smallest is 6 by 6 feet. The pictured gate, with frame, weighs better than 7 tons—14,700 pounds, to be exact. Greeley & Hansen of Chicago are the designing and supervising engineers; Crane Co., the gate fabricators.

THE SEWAGE TREATMENT WORKS OF RAYNE, LA.

By JOHN H. O'NEILL

Chief Engineer
Louisiana Department of Health
New Orleans, Louisiana

RAYNE, LOUISIANA, has recently completed a Works Progress Administration project, under the supervision of L. J. Voorhies, Consulting Engineer, which includes water supply extensions, a sewerage system, and a sewage treatment plant.

The treatment plant comprises pump pit and pumps, Imhoff tank, trickling filter with rotary distributor, secondary sedimentation tank, sludge filter bed, and chlorinating equipment. (See picture.)

Pumps—

Sewage flow is entirely by gravity to a 5400 gallon pump pit at the plant, from which it is pumped to the Imhoff tank by automatically controlled, electrically driven, non-clogging centrifugal pumps. Pumps are in a dry pit, and are in duplicate. Wiring and float controls are so arranged that pumps may be used alternately without re-adjusting floats, and so that the second pump will step in, when needed to carry heavy flows.

Imhoff Tank—

The Imhoff tank was designed on the bâsis of:

(1) A detention period of 1½ hours in sedimentation tank at pumping rate of 200 G. P. M.

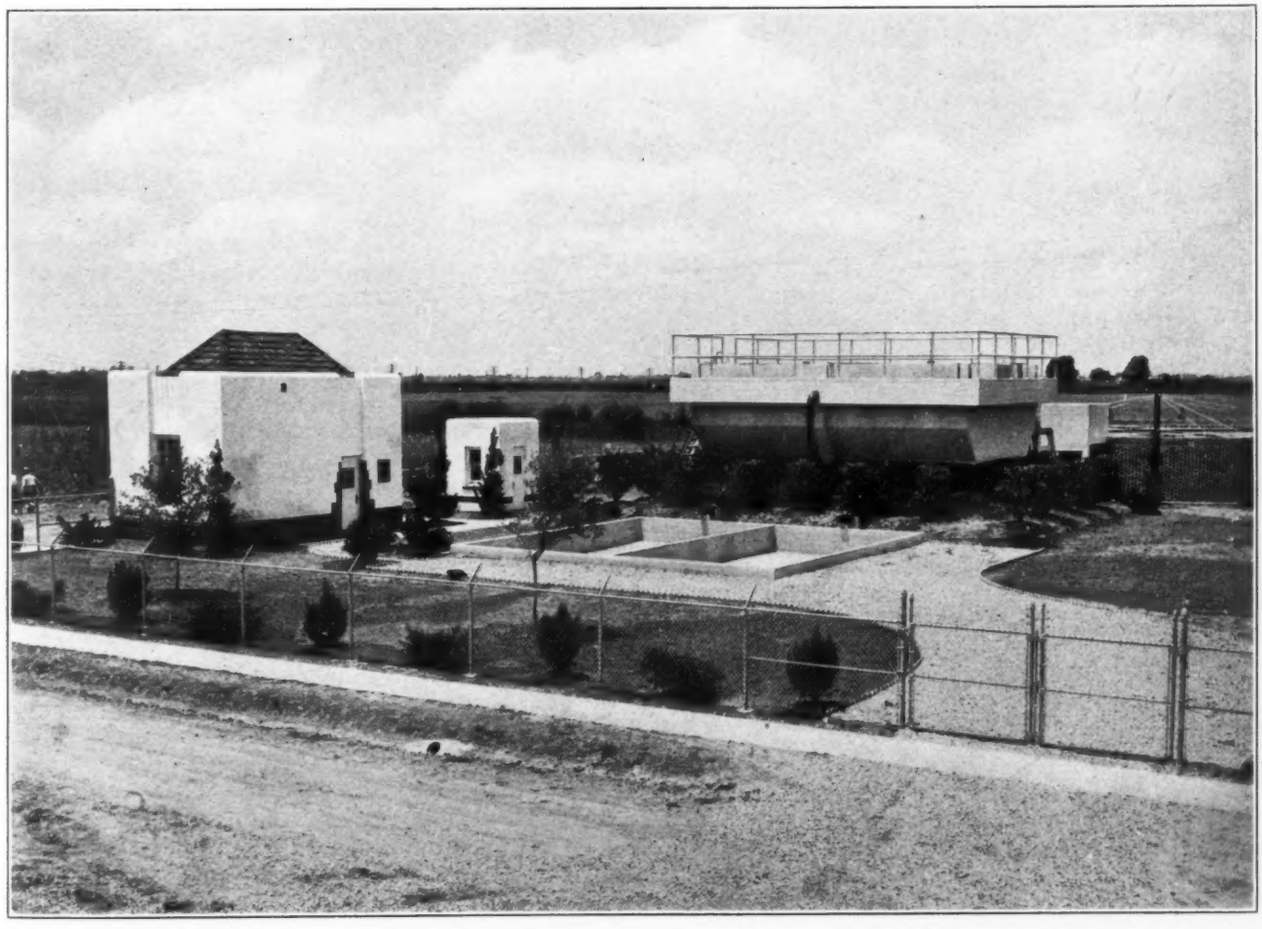
(2) A 1⅓ cu. ft. per capita sludge storage after allowing 3 ft. between slots and maximum elevation of sludge deposits.

From the Imhoff tank the settled sewage flows to a dosing tank, from which it is discharged by automatic siphons onto a trickling filter equipped with a rotary distributor.

Trickling Filter—

The trickling filter has a capacity of approximately 250,000 gallons per day on the basis of ⅓ million gallons per acre-foot per day. Filter material is crushed rock from 1½ to 2 in. size.

The filter effluent passes through a secondary settling tank. Settled sludge will be drawn from this tank to



Louisiana's Most Attractive (newest) Sewage Treatment Works (Built as a WPA Project for Rayne, La.)

the sewer pump pit and pumped to the Imhoff tank with the raw sewage.

A sludge bed is provided for the Imhoff tank sludge. Effluent from the sludge bed will be drained to the wet well of the pumping station and will be pumped to the Imhoff tank with the sewage.

The effluent from the secondary settling tank will be discharged into an irrigation ditch with a low rate of flow. It is expected, however, that with proper operation of the plant the effluent will be stable.

Three-Way Chlorination

The topography of this area necessitates the use of flat grades. To avoid odor nuisance, due to stale sewage arriving at the plant, a chlorinator has been provided to operate automatically with the pumps. Arrangements are made so that chlorine may be applied to raw sewage, to Imhoff tank effluent, or to final effluent. Or, the chlorine dosage may be split and chlorine applied at one, two, or all three of these points.

The plant has been surrounded by a wire fence and the area has been planted with flowers and shrubs.

Laboratory—

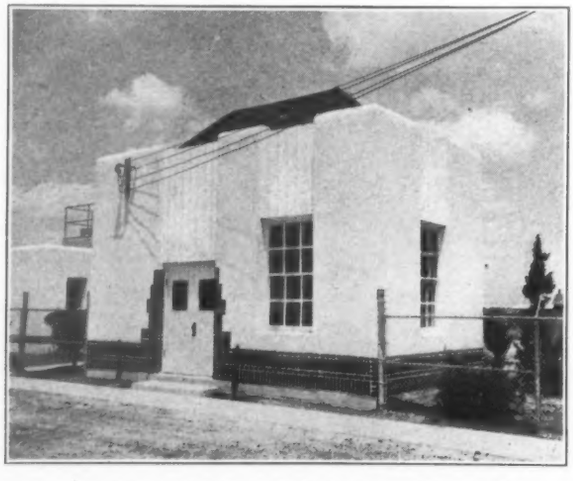
One corner of the pump house is equipped for laboratory control tests. Provision is made for methylene-blue stability tests at 37° C.; settleable solids tests by Imhoff cones, and for orthotolidine tests for residual chlorine.

The plant will be operated under the direction of the Superintendent of the Rayne Water Department, and will be supervised by the local health officer, who will make the control tests. Monthly reports showing daily operating records are to be submitted to the State Board of Health.

Public Interest a Feature

One of the interesting features of this project was the great interest shown by the public in the completion of the job—the value of plant beautification playing its part.

The improvements were "formally dedicated" on June 2, with an all-day celebration. Local merchants closed shop during the program, which included: a parade, with prizes for the best decorated floats; a public meeting, with speeches by officials of city, state and WPA administrations; a free barbecue, "come one, come all"; inspection of the plant; and a baseball game in the afternoon between Rayne and Opelousas in the Evangeline League. Your correspondent can vouch for the fact that "a good time was had by all."



The Pump Station and Laboratory, Rayne, La.

Pollution Legislation Hits Delaying Snag

Because the anti-pollution bill which last Spring passed the House (the Vinson Bill H. R. 2711) and the Lonergan-Barkley Bill, which passed the Senate in the closing days of the Congress differed to a point which could not readily be reconciled in the Conference Committee, legislation on stream pollution failed of passage in the recent Congress.

From the most reliable sources, however, there comes conviction that the next Congress, which will convene in January, will without question pass one or more bills which will definitely advance, if not enforce, stream and waterways cleansing. In the interim the two bills will lie in committee.

The Senate Bill passed August 16th is proposed as a substitute for the House Bill passed in April. The Lonergan-Barkley Bill is more drastic and seems to give to the Federal authority greater powers and to the State authority less force—the reasons given being the fact that individual State authorities, as now functioning, cannot fully secure the desired betterment in stream conditions aimed at.

The Senate Bill, like the House Bill, will place water pollution control under the U. S. Public Health Service, but in addition directs the enforcing agency to classify waterways into sanitary districts, fix boundaries of such, and establish standards of purity for the waters therein. It likewise directs the Federal agency to establish minimum requirements as to treatment of sewages and wastes discharged to such waterways. It authorizes any U. S. Attorney to bring action to prevent or abate polluting which, upon proof of violation, is construed under the proposed act to be a public nuisance. Such actions are, however, prohibited until three years after the date of enactment of the statute.

Like the House Bill, the Senate Bill provides for grants and loans to be made public bodies, and loans to industry, for the construction of treatment works. The chief difference in the two bills seems to lie in the greater power and jurisdiction accorded the Federal Government in the Lonergan-Barkley Bill as contrasted with the milder advisory action accorded the Federal agency in the Vinson Bill passed by the House. It now seems likely that a passable bill will come through as a compromise measure which will retain the most workable features of each. It is to be hoped that such an act will not submerge State authority to a degree that will prove too dictatorial and foreign to American methods, and so objectionable as to cause needless confusion, friction and ultimate defeat of the basic purposes for which is needed guiding Federal legislation; and, therewith, cooperation and aid to state, municipality, industry.

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Genesee Valley Sewage Workers Hold Third Meeting

The Genesee Valley Section of the New York State Sewage Works Association held its third meeting in Rochester, N. Y., August 12th, and adopted by-laws which will be presented to the parent-body for approval at the fall meeting to be held in Elmira, N. Y., October 15th and 16th.

Emmet Gauhn, Monroe County Sanitarian, presided, and introduced Dr. Henry Marcu of the United States Conservation Commission who addressed the meeting on the subject of "Stream Pollution."

LEAKAGE LOSSES

Some Experiences on the Rand Water Board System

By M. UDWIN

Chief Engineer, Rand Water Board, Johannesburg, South Africa

Here is a story which reveals the possibilities in progressive reductions in unaccounted for water through curtailed system leakage. The minimum attained in 1935 *probably establishes a record—to-wit:* 8.43% *in* 1909 *reduced to* 1.344 *by* 1935.

When it is realized what must be the cost of purification chemicals, imported into far-away Johannesburg by the Rand Water Board, and expense involved in a double pump lift against a 1,000 *ft. head and better, one can better appreciate the importance which leak reduction has to this South African utility. Rand's accomplishments and methods applied in minimizing water losses are worthy of note. Probably a new standard in water works practices has been established.*

THE Rand Water Board is a public utility corporation, constituted by law in 1903, to supply water in bulk to municipalities and other local authorities; to the mining industry; and, to the Railway Administration—all within the area of the Witwatersrand Gold Fields of South Africa.

The area of supply is approximately 1,900 square miles and extends in a west-east direction about 70 miles, with the town of Johannesburg (population 500,000) near the center of the area. The total population of 1,100,000, within the supply area, is made up of 431,000 European and 669,000 non-European inhabitants.

The Board draws its main supply from the Vaal River which has to, at all times, be subjected to purification. The purified water is in a stable condition—that is, it is not liable to cause corrosion of pipes or to deposit a coating on the mains. The supply from the river is supplemented by water drawn from boreholes which requires no purification, but its safety is insured continuously by precautionary treatment with chlorine.

The purification works are situated at Vereeniging on the Vaal River which is distant about 37 miles from Johannesburg. Inasmuch as the supply area is approximately 1,000 feet higher than the purification works, the water has to be lifted in two stages; the intermediate pumping station acts also as a distributing center.

Correction of Leakage Losses

During the existence of the Board the loss of water by leakage (including the water used in cleaning reservoirs and scouring mains) has been carefully checked, recorded and given a deal of consideration with an aim toward reduction. In the earlier years of the Board's existence the loss was considerable but by paying attention to numerous details, to which reference is made below, the loss has been gradually reduced. For the year ended on March 31, 1936, it had been curtailed to the low figure of 1.344 per cent of the water pumped.

The following table shows the losses over periods of the past twenty-seven years:

Period	Average Loss Percentage of Water Pumped
1909-1910	8.430
1911-1915	5.460
1916-1920	4.352
1921-1925	3.907
1926-1930	1,812
1931-1935	1,772
1935-1936	1.344

The following details concerning the magnitude and nature of the operations of the Rand Water Board, with some notes on the factors which have contributed to minimize losses by leakage, may be of interest to engineers and others responsible for waterworks.

The various consumers (municipalities, mines, railway works, etc.) receive the water through meters and the responsibility of delivering water to houses, industrial concerns, etc., devolves upon the local authority. The water is accepted in bulk and there is a constant passage of water through the meters. As the meters are constantly recording, the condition of low flows (those insufficient to overcome the inertia of the meter) does not obtain and this is a factor which contributes to minimizing the apparent loss of water and unaccounted for water.

The total number of meters in use is 533. The quantities of water passed through these meters on the year ended on March 31, 1936, were:

	No. of Meters	Imperial Gallons
Municipalities	151	4,633,127,000
Gold mines	215	4,306,856,000
South African Railways	52	767,455,000
Sundry consumers	115	368,683,000
	533	10,076,121,000

Very few of the meters supplying water to the smaller consumers pass so little water as 5,000 gallons per month.

The water pumped from the purification station to the intermediate pumping station is measured by Venturi meters on the pumps and is again measured over weirs on arrival: the water is again measured on being pumped from the intermediate station to each of the five supply branches and these readings together with the differences in storage reservoirs are checked daily against the meter readings of supplies to large takers and sundry consumers.

Close Attention to Meters and Joints

An extensive program of meter-testing and calibration is carried out: all meters on the system are tested in rotation and older meters are gradually being eliminated and replaced.

The system consists of 366 miles of pipelines made up of 342 miles of pumping and gravitation mains and 24 miles of collecting mains from boreholes.

The maximum size of any main is 44 inches diameter (111,000 feet) and there is very little pipeline in use smaller than 12 inches diameter.

The majority of the pipes are made of mild steel, with specially designed inserted joints filled with run-lead. The thickness of the metal of the pipes varies from ¼ inch to 11/16 inch, according to the working pressure. As the delivery area lies approximately 1,000 feet above the purification works pressures up to 550 lb. per square inch have to be provided for in some sections and along these tracks the pipe-joints are specially secured by gland rings.

Attention may be called to the fact that the consumption of water has progressed during the last 30 years as follows:

Year	Average Daily Supply Imperial Gallons
1905-06	2,331,000
1915-16	9,140,000
1925-26	12,600,000
1930-31	17,785,000
1935-36	27,530,000

This expansion of work has necessitated the constant installation of new pipe lines and the replacing of smaller pipes by mains of larger size.

Great attention has been paid to the internal and external protection of pipes and all pipe-laying and jointing is carried out departmentally and *not* by outside contractors. In refilling pipe trenches specially selected soil is used particularly in contact with the pipe and, wherever possible, refilling with laterite is avoided.

The pipes are mainly laid in open country in shallow trenches, as a rule with about 2 feet of cover, and leakage is easily and quickly detected.

The area covered by the pipe system is divided into Districts each under a District Plumber with adequate facilities for undertaking minor repair work. The whole length of the pipe system is patrolled *twice* daily, consequently no serious loss of water can take place by leakage without being quickly detected and attended to.

A record of all leaks and their causes is kept and if recurring leaks occur in any particular section of the system complete replacement or additional protection is undertaken in that section.

As previously noted, loss of water due to leakage, and water used in cleaning storage reservoirs and scouring mains, was reduced during the year ended on March 31, 1936, to 1.344 per cent. Such low leakage, and water otherwise not accounted for, may be attributed to the following factors:

(1) Water is supplied mainly in bulk to large consumers under whose charge lies the further reticulation to supply individual users.
(2) The pipeline system is maintained in first class order.
(3) Leakage is quickly detected and necessary repairs effected at once.
(4) A very close daily check is kept on all meter readings.
(5) The pipe joints in use are all made with cast lead.
(6) A system of overall checks is provided by the metering system, the units of which are maintained in a condition insuring accuracy.

Practical Carbon Testing

How One Operator Evaluates Carbons by the "A.B.C. Method" on the Principle of It's Results That Count

By B. G. YAXLEY
Supt. Water, Waterford, N. Y.

B. G. Yaxley

MUCH has been written about the testing of carbons that are used in the waterworks field. Phenol value, threshold odor, and other tests are common to the profession, but how about the operator, with little or no laboratory equipment and a like deficiency in technical training, who wishes to use the best material for his particular trouble. Here is how one operator solved the problem.

In a majority of cases taste troubles can be cured by application of the carbon to the top of the filters. The feeding of the material in the entrance of the sedimentation basins will require heavier doses for the same results, but in some instances it is necessary. Anyway, feeding on top of filters is a good place to start and, in the case to be discussed, was the method used.

The plant in question has two basins, operating in parallel, and four filters. Design is such that the plant can be separated into two independent sections and operated in that manner.

A well-known make of carbon had been used whenever required (continuous use not being necessary), but the operator thought that perhaps some other brand might be better and wanted to be sure of using the most effective material for correcting the local condition.

The plant was divided into the two sections. A dry feed machine (the regular carbon feeder), was rigged to discharge into the outlet of one basin and the spare solution feed tank, having a power agitator, was connected to the other basin outlet. The carbon being used was supplied to one-half of the plant in sufficient quantity to nearly clear up the objectionable conditions, but not quite, as it was important that a slight taste be left for comparative purposes. The carbon under test was used in the other half, care being taken to feed equal quantities. Then, after operating about a week so as to have things stabilized, tests of filter effluent were taken.

Three different carbons were tested in this manner and the results were somewhat surprising. One sample caused a marked reduction in color, which the regular material did not do; another failed to do much of anything. The result of the trials was proof that the material in regular use was the better for our particular conditions.

The important part of this method of testing is that the two materials under observation are used under identical conditions and on a plant scale. Any attempt to run tests in rotation is of questionable value because exact comparison is not possible. In this case the supply was from a river and each day "knoweth not what the future bring'th."

These tests were run some time ago and since that time the plant has adopted heavy pre-chlorination, with a midsummer demand as high as fifty pounds per M.G., but that is another story.

N. C. WATER AND SEWAGE WORKS ASSN. MEETS IN WILMINGTON

In God—and, Two Gauges!
(Beneath the Reserve Gauges of the Two Boilers of Wilmington's Pumping Station the late John Sweeney, Superintendent, Hung the Above Sign Some Years Ago.)

THE North Carolina Section of A. W. W. A. and the North Carolina Sewage Works Association met jointly in Wilmington, N. C., August 26th, 27th, and 28th. The disappointing registration of 150, or thereabouts, was apparent proof that the mid-summer dates selected for trial this year are not as conducive to a representative attendance as have been the November dates of past years. On this account the two associations voted to return to the custom of holding meetings in November, on dates contiguous to those of the annual meetings of the Virginia Water and Sewage Works Associations.

Why a Joint Water and Sewage Works Ass'n?

Professor H. G. Baity, long secretary of the joint association and this year its president, in response to the welcoming address reviewed the history of the North Carolina Section of A. W. W. A. since its 1920 organization meeting in Greensboro, seventeen years ago. At that time, he said, Wilmington was the only North Carolina city employing a trained chemist to operate its purification plant. Shortly thereafter this man, George C. Catlett, was released to the new Sanitary Engineering Division of the State Department of Health, where he became a "wheel-horse" with H. E. Miller in putting North Carolina on the map in respect to water purification facilities and plant operation. The association had during its life witnessed markedly improved water facilities and management in practically every North Carolina city. Much of this progress had been due to solidification of interests—health and utility—through the association's activities. Later came the N. C. Sewage Works Association and its meetings had been held jointly with the Water Works Association because almost universally, in North Carolina, the same men have charge of both water and sewage works.

The Retiring President Dr. H. G. Baity

The Incoming President J. W. Kellog

President Dugger on Hand

Eugene F. Dugger, President of A. W. W. A., attended all technical and business sessions and presented a splendid and clear cut address on "A. W. W. A. Affairs" at the annual banquet, several of his proposals being later discussed and voted on in the business sessions of the Section. He paid high compliment to the prowess of the North Carolinians who had built up one of the strongest and most active of A. W. W. A.'s sections and, thereby, had taken the Nicholas S. Hill Cup for maximum percentage increase in membership three years in succession. That the Association, showing a membership gain of better than 300 since January 1, 1937, should continue to grow was of highest importance if A. W. W. A. was to render the most efficient service to the greatest number of water works men. He outlined suggested methods to be pursued by section committees in membership building through personal solicitation supplemental to direct mail appeals.

To make the work of sections more effective and the association more serviceable to all members, Mr. Dugger sees the need of a section in practically every state rather than continuing those less wieldy and less serviceable sections now covering several states. He cited the status of North Carolina Section, and other single state sections, as evidence of potential accomplishments in membership building, and in creating interest and producing service. In order to reach and serve the greatest numbers of water works operators the matter of establishing some form of affiliate membership, with reduced dues, was being studied by a committee. The Association had gone on record as advocating and encouraging operator licensing and at present the Executive Committee was looking into additional ways and means of overcoming the apparent short tenure of office of the average water works official. It was the aim of the Association to produce a vocational consciousness and, therewith, security to water works operators comparable to that of other professions and trades.

Getting away from association affairs, the balance of President Dugger's thought impelling address, which fell on the most attentive audience that it has been the privilege of this writer to witness in some time, dealt with the highly important consideration—"Public Relations." Warning of a trend toward possible Federal control of all public utilities, Mr. Dugger proceeded to show that where politics came in, efficiency and recognition of business-like operation and management went out. To overcome any local wish for Federal Control, "good-will" was the greatest asset to be had. Furthermore, interference was least where "good-will" of the consumer and the public-at-large had been most suc-

National Director, P. W. Frisk, Enka; Nominating Committee Chairman, A. O. True, Greensboro; Secretary-Treasurer, A. R. Hollett, Chapel Hill.

cessfully built up. Mr. Dugger, well equipped as the successful manager of the water works of Newport News, Va., then outlined methods which he recommended as of equal value to the publicly owned as to privately operated water utilities. In order, these were (1) Polite and courteous contact employees; (2) Maintaining a clean, well-kept and attractive plant, offices and equipment; (3) Improved plant facilities and service to the consumer; (4) Courteous and considerate conversation over the telephone when complaints or questions come in; (5) Know and cultivate local newspaper editors and give them stories designed to create public interest and respect; (6) Invite the public to learn "what's behind the faucet in their homes" and show them well.

Mr. Dugger emphasized the fact that "Our pride as water utility operators has always been that *efficiency counts most,* and that there is no place in our work for politics or political considerations." To maintain the high standards set, it would be more necessary now than ever before to give the best service possible, make friends, and fight against anything that may permit injection of politics into water utility operation. With a sincerity of purpose, Mr. Dugger's inspiring talk registered; and, without much doubt, many who heard him are already planning accordingly.

Maffitt Cup to Moore

The silver cup donated to the Section by McKean Maffitt of Wilmington, as an award to the member who is responsible for securing the largest number of members during the year, was presented by the donor to George S. Moore, Supt. of Water and Light, Albemarle, N. C. The No. 1 membership salesman was especially complimented by Mr. Maffitt due to the fact that this was the second consecutive year in which he has won the cup.

Donor and Winner of the Maffitt Cup

M'Kean Maffitt, Engr. and Supt., Water and Sewage, Wilmington; Geo. S. Moore, Supt., Water and Light, Albermarle.

Entertainment

On the opening evening of the convention, members and guests were tendered a complimentary dance at famed nearby Wrightsville Beach, the host being the City of Wilmington.

Those attending the Annual Dinner the following night were entertained by two amateur magicians. One of these, F. L. Bunker, Charlotte representative of Chicago Pump Company, put on a particularly spectacular and baffling show, ranking with the best of the professionals, to bring many encores.

Business Sessions

After a count of ballots the following officers were declared elected for 1937-1938:

President—J. W. Kellog, State Lab. of Hygiene, Raleigh.

Vice-Pres.—R. A. Thomas, Comm. Public Works, Winston-Salem.

Secy.-Treas.—A. R. Hollett, City Engr., Chapel Hill.

Members of Board of Control, Sewage Works Federation—Prof. H. G. Baity, Chapel Hill, and W. M. Piatt, Durham.

The President and A.W.W.A.'s "First Lady"

E. F. ("Gene") Dugger, Mgr., Newport News (Va.) Water Works and Mrs. Dugger.

Chairman of Nominating Committee—A. O. True, Greensboro.

Greensboro, the birthplace of the Section in 1920, was announced as having been selected by the Executive Committee as the place of the 1938 Convention. The dates, yet to be selected, will be the first or second week in November.

The report of the Secretary-Treasurer revealed a total membership of 94 in the A. W. W. A. Section, 85 of which were also members of the Sewage Works Association. During the year 24 members had been added as new or reinstated members lost during the late depression. Collections had improved also and cash balances of $201.70 and $209.45 were on hand for the two associations—water and sewage, respectively.

As Chairman of Committee on Operator Licensing, W. M. Piatt reported that the Operator Licensing Bill prepared had successfully passed the State Senate but in the rush of last-minute legislation had been killed in the House of Representatives, after having been forced out of the Calendar Committee in the final hours. The chief argument against the Bill was that it was a measure designed to force increases in salaries to water works operators by reducing the supply of men eligible for the jobs—an interesting appraisal. The defeated Bill is to be distributed to members of the Section with the in-

1. Back "Down Home" Came the Hedgepeths; 2. H. C. Drummond (Charlotte) and Herbert Ickler (Philadelphia) of Johns-Manville Company Must Be Checking Over Prospects for "Transite"; 3. Row 2, During a Technical Session; 4. To Their First Convention Fred Stuart Brought a Dark Gentleman—Mr. B. Alum—and His Side Partner, Mr. "Stan" Alum; 5. E. V. Young, Southern Sales Manager, Universal Pipe Co., and John Woodson, Sales Manager, Lynchburg Foundry Co.—Says John: "Young's Pipe Has Got 'Dog Ears'."

tent of securing suggestions looking toward an improved Bill for reintroduction in the 1939 legislature.

At the close of the session it was announced that W. M. Piatt had been honored by the Carolina Engineering Association as recipient of an award "to that engineer doing the most for the good of his profession."

Technical Sessions

(H. G. Baity, Presiding)

The Technical Sessions opened with a description of **"The Water Supply Facilities of Wilmington,"** presented by McKean Maffitt, Engineer and Supt. of Water Works and Sewerage, Wilmington, N. C.

Mr. Maffitt, in his capable manner, told how in 1881 the original water company had been formed to provide fire protection and sewer flushing only. All domestic supply came from individually owned driven wells and a typhoid rate of 70 to 90 prevailed. Agitation, started in 1905 for a public supply, resulted in purchase of the private system in 1910, and ever since the city has operated the water works and sewerage system under a single head. In the same year (1910), the first filtration plant was constructed; was further enlarged in 1919. In 1922 the plant was electrified and the intake, subject to too great pollution and salt water incursions (4700 p.p.m. Cl. at times) was extended to a point 7 miles up the meandering Cape Fear River, by running a direct line only 2 miles long to a new river pumping station. The latest improvements (1935) involved additional filters, extensions of mains, additional pumps and the covering of the circular reservoir.

Mr. Maffitt told of some of the many vicissitudes and difficulties met with in constructing an intake basin and the new 24 inch C.I. raw water line through the swampy lands, necessitating the use of trestle work on piling and a syphon under North East River. In his experience, as an engineer, dealing with the bottomless mud was the toughest job he had ever tackled. In describing the present plant, with filter capacity of 6.5 m.g.d., the raw water pumps would deliver 4 m.g.d. each and filtered water pumps 7 m.g.d. (3 units) against the 200 ft. pumping head. As a standby unit a Morris 4 m.g.d. unit direct connected to a Sterling gas engine had been installed and the two early steam pumps (1910) were always ready for service.

Mr. Maffitt exhibited a most complete system of record map keeping of the 60 miles of mains with 479 hydrants. Valving had been arranged to preclude the necessity of cutting out more than 1 city block or more than one fire hydrant at a time. Every hydrant would soon be equipped with branch valves—296 being in at present. The record maps, a complete set of which were carried by each truck, consist of 43 section detail maps, covering 20 or fewer blocks each, show exact locations of every hydrant and valve. Detailed corner maps (indexed by street numbers) give the make and opening direction of every unit, and exact bearings and distance of each from permanent objects as well as hydrants. In paved streets all valves (large or small) were being placed in valve chambers (vaults) of ample size.

Concerning valve maintenance, Mr. Maffitt told how Wilmington's valves were kept in free operating condition by enclosing all bevel gears in axle grease (newer valves being so equipped by manufacturers); and how home-made cups, constructed around stem and stuffing boxes, were kept filled with grease. Important valves, formerly requiring two men to operate them, could now actually be whirled shut or open. Every valve of importance received at least yearly inspection.

Metering was now essentially complete and the last 20 miles of old galvanized pipe extensions were being replaced with cast-iron. Meters, when installed on the old extensions, had been responsible for a doubling of revenue over the flat rate collections from consumers on these small and corroded lines.

Mr. Maffitt eulogized the late John Sweeney, who had died in harness after 50 years of service as Superintendent of the Wilmington plant. He was likewise high in praise of the son—J. H. Sweeney—who has succeeded his father as Chief Engineer of Plants; of J. D. Mote, Assistant Superintendent, now having 43 years of service to his credit; of L. I. Lassiter, Sanitary Engineer, in charge of purification. In a burst of what bordered on oration, in typical "Maffittonion" style, he pictured the high regard shown the British water works manager as compared to that shown the average American manager; and, he besought his listeners and the Association to do something to build a greater future for water managers and engineers in America, suggesting means that came to his mind at the moment.

L. H. Enslow, paid high compliment to Mr. Maffitt on the excellence of his presentation, his ability as a speaker and leader, his prowess as engineer and man-

Stephen G. Worth, Worth Reporting Co., Fayetteville (for 10 years Has Been Stenotyping N. C. Meetings); Wm. M. Piatt, Consulting Engr., Durham (voted, "That Engineer Who Has Done Most for His Profession."); F. L. Bunker, Chicago Pump Company, Charlotte (as Amateur Magician, Out-Professionalled Professionals.—Note Any Mephostolic Resemblance?)

Wilmington's "Three Horsemen"
(Praised by Their Boss)

L. I. Lassiter, Supt. Filtration; J. H. Sweeney, Plant Engineer; J. D. Mote, Asst. Supt. (To Mr. Mote, a Bow for 43 Years of Service.)

ager of utilities—proof being his accomplishments and interest in bettering the profession.

In reply to Mr. Enslow's request for more details in respect to his exact valve locating procedure, Mr. Maffitt explained that three points were used in noting measurements and angles—hydrant, curb and other valves. In addition, the dipping needle was used; but he believed that the modern radio type locators were to prove one of the greatest boons to water works men in valve and pipe location and seemed likely to outmode all other methods. In reply to other questions, he said that all important valves suffering internal corrosion had been equipped with bronze parts, the more important ones also having bronze gates. Grease enclosed gears were being specified on all new valves, and grease cups around the stuffing boxes of the smaller valves.

D. M. WILLIAMS, Engr., Water Works, Durham, N. C., also paid his compliments to Mr. Maffitt and told of their very similar map record system used in Durham. All valves 6 inch and larger were being placed in brick vaults, on unpaved as well as paved streets. As a result, less trouble had been had due to unpaved street maintenance. They had recently purchased a radio type pipe and valve locator which had proven a "jewel," and a great saver in repaving costs. Stub-end services, lost for many years, had been for the first time successfully located.

Bromine from Sea Water

The proposed visit to the Ethyl-Dow Company plant near Wilmington, at which bromine is recovered from sea water for the manufacture of the ethylene-bromide used with tetra-ethyl lead in production of Ethyl gasoline, had to be cancelled because of repairs and construction of a 2 million dollar unit under way. Mr. Maffitt, however, briefly outlined the process, which involves the pumping of 73,000 gals. of the bromine bearing seawater through the plant each minute. In displacing 42 of the 60 parts per million of bromine contained, the water is slightly acidulated with sulphuric acid (17 tons per day required) and chlorinated with 6 tons of chlorine per day, to liberate the bromine by substitution. With steam and air, the bromine is blown out and condensed as liquid bromine.

Aerobic Decomposition of Sludge Deposits

An outstanding contribution was a paper by the President, DR. H. G. BAITY, Dean of Engineering, University of North Carolina, which recorded findings from experimental studies revealing important considerations and **"Factors Governing the Aerobic Decomposition of Sewage Sludge Deposits"** in water courses. The work was originally done by Dr. Baity as a thesis problem while taking graduate courses at Harvard University in 1925 and 1926, but has remained unpublished. The study was undertaken to determine basic factors in respect to rates of bio-oxidation of submerged sewage solids, under various depths and with various thickness of the deposit, as against rates of re-aeration. Therefrom came a picture of stream loading possibilities without nuisance production, in salt as well as fresh waters. The work was done in a battery of 14 glass carboys of 5 gal. capacity. Through these water was run to simulate mild stream flow. Dr. Baity described the specially designed equipment and control analytical methods used.

Without thought of doing justice to the thesis, profusely illustrated by numerous graphs and charts, only the more important conclusions reached can be cited from Dr. Baity's studies involving effects of varying the dissolved oxygen in the overlying water, sludge depths, sunlight, salinity of water, temperature, pH. The report is replete with information of a basic nature which will deserve study.

A study of rates of demand and total demand of oxygen at 22 deg. C. revealed a rapid initial rise for 48 hours followed by a much slower but steady rate during 36 days, after which action ceased. Then, after 72 days of no oxygen input (water flow) and resulting anaerobic sludge condition, oxygen demand again came into evidence and continued at rates about the same as those noted in the aerobic stages. Studying the effect of varying the dissolved oxygen concentration in the overlying-water, between 0.1 and 6 p.p.m. D.O., it was found that the rate of demand and total demand was essentially the same for all oxygen concentrations, so long as some dissolved oxygen was maintained even though in very small amounts. Between 0.1 and 6 p.p.m. D.O. the departure from the mean proved to be only a 6 per cent variation in *rates* of oxygen demand, as well as the 36 day total oxygen consumed per unit dry weight of solids. Studying the effect of sludge depth on rates of oxygen depletion, it was noted that doubling the depth of sludge reproduced only about 1.5 times the rate of oxygen demand (oxygen depletion in the water above) per unit of surface area of sludge—namely:

Sludge Depth (centimeters)	Demand Rate (m.g.m. 0/sq. cm. surface)
0.5	1840
1.0	2890
1.5	3450
2.0	3765
4.0	5170

The conclusion is that oxygen demand of undisturbed sludge deposits is primarily a surface phenomena, the aerobic effects extending little deeper than 1 centimeter

H. P. Eddy, Metcalf and Eddy, Engrs., Boston, Mass.

H. E. Thompson, Supt. Utilities Chapel Hill, North Carolina, Retiring Vice-President.

into the sludge. Putting it differently—sludge deposits can only be maintained aerobic for depths of 1 centimeter.

Studying the effects of sunlight vs. darkness revealed no difference in rates or total oxygen demands. A study of temperature showed the Phelps' formula revealing rates at various temperatures to hold—the ratio between 22.3 and 28 deg. C. being 1.62.

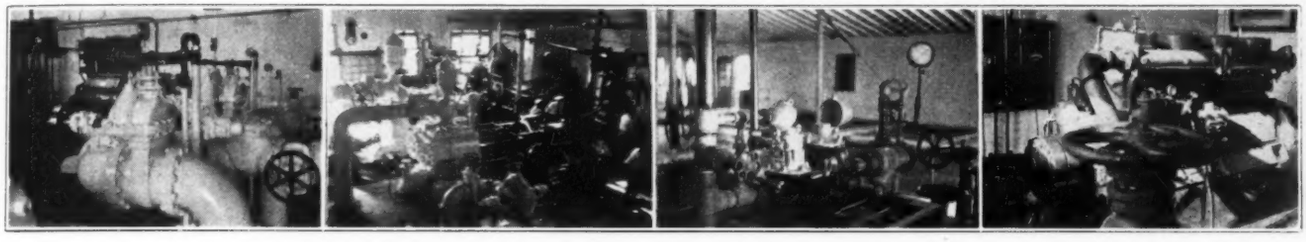
Comparing fresh water with brackish water (10,000 p.p.m. chloride content) revealed initial rates like those in fresh water but, thereafter markedly slower rates of oxygen demand were noted under the saline water—the rates being but 1 for the saline as against 2.5 for the fresh water. Concerning the total oxygen demand (36 days) the ratio was 1 to 1.83. [These two figures are especially indicative of re-aeration and dilution requirements as between fresh water and brackish waters, hitherto not revealed. Likewise, economically important in arriving at sewage treatment requirements under the two conditions.—Ed.]

Concerning bacteria, there was a very rapid initial drop. An initial 500,000 b. coli per C.C. decreased to 100 per c.c. after 200 hours in fresh water, but only to 5,000 per c.c. in saline water. Conversely, in the saline water protozoa disappeared more rapidly than in fresh water.

put of 0.48 cu.ft./gal./hour (4 cu.ft./gal.) which was, however, not considered the possible minimum.

In adding the dye waste at controlled rates, to secure 1.5 per cent by volume to the domestic sewage, 50 per cent of the color was removed ahead of aeration and 50 per cent during the first 15 minutes of aeration with added activated sludge. In respect to suspended solids and/or color removal, involving trials with 500 to 3200 parts of suspended solids carried in the aeration tanks, 2500 parts proved to be the optimum. In respect to B.O.D. removals but little effect was had by varying the solids. It was revealed, however, that the higher the solids carried the greater the solids destroyed. Proof that the sodium sulphide in the waste is the most objectionable ingredient was shown by the markedly superior results obtained when the dye waste treated was free of sulphide. The report revealed that the waste contains caustic soda, sodium sulphide, dye and salt. The B.O.D. averages 10,000 p.p.m. and pH runs above 10.5, thus making it important to control the ratio of additions to the sewage rather than admit the waste directly to the mixed liquor.

Replying to questions, Mr. Miles said that it was difficult to distinguish between chemical oxygen demand and the bio-chemical demands in the dye waste. The sulphide exhibited an immediate demand but not as high



Wilmington's Spick and Span Pumping Station

1. *Centrifugal Pump Line; 2. Standby Steam Pumps; 3. Universal Meter Test-Bench (J. H. Sweeney, Designer); 4. Standby Sterling Engine.*

L. H. Enslow, in complimenting Dr. Baity, said that it was regrettable that his thesis had not been published earlier because of the basic information contained. The general findings applied in sewage treatment operations as well as in natural purification by dilution, and nuisance prevention in waterways. Furthermore, there was economic significance in his findings which would apply in selection of minimum treatment for brackish water courses, as compared to fresh water streams. Basically, Dr. Baity's findings could be used to explain the performance trends of the activated sludge process, sprinkling filter beds, slow sand filters, the bio-precipitation schemes, and tapered aeration.

Sulphur-Dye Waste Treatment

The Textile Research Foundation, through the University of North Carolina, has established a program of research looking toward the effective treatment of wastes from textile mills. From the experimental station, now located in Greensboro, came a progress report on **"The Treatment of Sulphur Dye Waste by the Activated Sludge Process"** from Special Investigators H. J. Miles, Ralph Porges, and Dr. J. C. Geyer of the University of North Carolina.

Operating the activated sludge process on a fill and draw basis for 4 months, as the preliminary step, it had been found that 3 per cent by volume of sulphur-dye wastes could be added to the domestic sewage of Greensboro and produce an effluent of 15 p.p.m. B.O.D. The aeration period employed was 9 hours with an air in-

as anticipated. No success had in determining the Nordell Number with the Odeometer. The fill and draw tests were merely the feeling out tests to be followed by larger scale tests involving continuous flow.

Something Novel in Sewage Treatment

When Carl E. Trexler, Salisbury's City Chemist, told how **"Increased Efficiency of Solids Removal"** had been attained at the Salisbury plant (separate sludge digestion type) he had many old timers putting on their thinking caps. The process might be called the "Unscrambling of Separate Digestion" or "How to Solve the Supernatant Liquor Question." Whatever one may think of the confoundingly surprising method of the young Salisburian, he insists that it's the results that count and here is his story:

The Salisbury works, constructed as a separate digestion plant, to provide primary treatment with 1½ hours' detention, performed none too well because of textile mill wastes. The result was a poor effluent, sludge deposits in the stream and poor resulting conditions below the works. Chemical precipitation with lime and other coagulants proving too costly, and finding the disposal of poor supernatant liquor (without chemicals) troublesome, Mr. Trexler struck upon the idea of dye color adsorption by running thin sludge (thick supernatant liquor) back into the crude sewage. The result was a noticably clearer effluent with less residual of dye waste color. This, Mr. Trexler believes to be due to a reaction between the suspensoids and colloids of mill waste

the crude sewage, and the sludge bearing liquor from the digestors, to produce settleable conglomerates which take out much of the dye by adsorption. The procedure, now in operation for a full month, suspended solids removals had been increased from 65 per cent to 93 per cent. On the other hand, removals of the settleable solids had only been increased 8 per cent (89 pct. raised to 97 pct.) had indicated the effect to be that of converting non-settleables to settleable solids which became subject to removal in the 1½ hour settling period. There had also been noted a reduction in B.O.D. of the effluent, increased gas production, a denser sludge of improved draining and drying qualities. In every respect the scheme had proved beneficial to plant operation at no additional expense beyond the increased pumpage of sludge circulated through the digesters. In solids removal, the results had been not alone superior but far less erratic. Stream analyses had confirmed the more uniform results in plant operation.

In reply to questions, Mr. Trexler said that the watery sludge added to the crude sewage was drawn from the 20 ft. deep digesters at the 10 ft. level. No figures on percentage return were available. The settled solids, pumped more continuously from the settling tanks to the digesters, had been easier to handle because somewhat more watery. He had brought along no figures on B.O.D. values of the effluent but these were on record in Salisbury. There had been a noticeable stream improvement just below the plant with dissolved oxygen now present. [Mr. Trexler has since supplied B.O.D. figures, indicating an average added removal of 20 p.p.m. since introducing the new procedure.—Ed.]

L. H. Enslow in commenting on the Salisbury method said that to him it seemed to be a new development in the elutriation of digested sludge—possibly an infringement on the Genter patents. He could understand the improved appearance of the effluent in respect to color and suspended solids but wondered what the overall effect in B.O.D. removal would reveal due to the washing out of soluble products and, therefore, what the result in stream loading would show.* To him the whole scheme sounded as though septic tanks might be the more economical, but he understood that the State Department of Health had ruled these out in North Carolina.

In talking with the inventor after the session, this scheme may prove another case of "every tub on its own bottom"—when considered in respect to Salisbury conditions. There may prove to be something here that seems so strange to accepted practice that it isn't strange, when all facts are weighed. With adequate data on effluent oxygen demands and stream quality "before and after taking" Mr. Trexler may prove benefits beyond those which already appeal to him as operator of a plant harassed with textile mill waste and digester problems. If proven good for the stream it may likewise be proven good for secondary treatment processes and, therewith, a solution of an extensive problem in the South—namely, What to do with textile wastes.

D. S. Abell, Prin. Asst. Engr., N. C. Dept. Health; Dr. C. W. Borgmann, Research Dept., National Tube Company; Carl E. Trexler, City Chemist, Salisbury, N. C.

"Newly-Weds"—Fred Dimmick (Richmond), and Mrs. "Fred" —Nee Richmond's Captivating Lilly Lassiter

*[Note.—Since this report was prepared Mr. Trexler has supplied B.O.D. figures on the effluent which indicate an average increased removal of 21 ppm.—120 ppm. vs. 99 ppm.—since introduction of the sludge return procedure.—Ed.]

Special Water Treatment Problems (A Symposium)

"Treatment of Natural Waters for Prevention and Control of Corrosion" by Dr. C. W. Borgmann, Dept. of Research, National Tube Co., Pittsburgh, Pa.

Dr. Borgmann in discussing the principal factors in water corrosion of iron and steel said that dissolved oxygen remained the chief offender and that in soft waters corrosion rates were not materially different between pH values of from 6.0 up to 9.5. Strange to many, it could be shown that carbon dioxide had little effect in soft water corrosion. Temperature increase doses have some effect up to 160 deg. F. and velocity of flow has a great effect in sweeping away the protection products laid down on the interior surface of pipes. Another contradiction of popular belief was his statement that the calcium salts (Ca ions) were more productive of corrosion than magnesium ions; potassium ions more so than sodium ions; and, nitrates, being oxidizing, were less rapidly corrosive than chlorides.

Concerning treatments for municipal supplies, the production of a calcium carbonate depositing water still seemed the most practical. Silicate treatment to the extent of 8 p.p.m. Si O_2 was effective in checking redwater rather than corrosion. Southern waters as a rule were already silica rich—20 to 30 per cent of their total solids being silica (Si O_2). In industrial supply treatment Dr. Borgmann briefly discussed the application of inhibitors, including high dosages of alkalies, bromates, chromates, aluminates, silicate. As to aluminates and chromates there was danger of localized pitting, especially at the water line in boilers. Such treatment had proved safer for hard than soft waters and waters low in chloride or sulphate content. Other inhibiting materials discussed were gelatin, tannin, Bentonite clays, emulsified oils. A new process, involving the laying down of a dense rust film, had promise. Stainless steel received its protection from a thin oxide film of but 3 molecules in thickness. The copper bearing steels containing 1 per cent chromium and 0.5 per cent copper corroded in soft waters at a rate one-half that of ordinary steels.

In reply to questions, Dr. Borgmann stated that a study of dissolved oxygen depletion would not reveal the corrosion rate because of utilization of the oxygen in producing oxide products in addition to advancing corrosion. Actually, in soft waters dissolved carbon dioxide sometimes seemed to be helpful against corrosion. And, so, another pet theory gone to smash!

"Treatment of Boiler Feed Waters" by P. W. Frisk, Chemical Engr., The Enka Corp., Enka, N. C.

Mr. Frisk pointed out that it was "every tub on its own bottom" when it came to determining the best treatment for boiler waters—a problem for the experts who have made a study of boiler water conditioning and had benefited from experience with various combinations of conditions. After discussing fundamental principles of boiler water conditioning, Mr. Frisk cited the important constituents of boiler water and methods for their determination on samples taken from the boiler. These included total alkalinity, pH value, dissolved solids, sulphates, chlorides and sodium sulphite, if used. To prevent the muchly talked of caustic embrittlement he cited the recommendations of the Boiler Code Committee of A.S.M.E. that the ratio of alkalinity (expressed as $Ca\ Co_3$) to the sulphate content (expressed as $Na_2\ So_4$) be maintained as follows:

Lbs. Working Pressure	Ratio Alk./$Na_2\ SO_4$
0-150	1 : 1
150-250	1 : 2
250-up	1 : 3

To prevent formation of undesirable analcite scale, from alum treated silicate bearing waters, sodium phosphate was largely used to precipitate calcium and magnesium; and, through the increased causticity, to hold silica in soluble form. To prevent corrosion, deaeration and sulphite additions were being practiced to reduce dissolved oxygen to less than 0.1 c.c. per liter. Mr. Frisk then discussed the matter of type of boilers and their respective duty, as affecting the type and degree of treatment.

In later discussion Mr. Frisk pointed out that at the Enka plant, where 4,000,000 pounds of steam are produced by boilers operating under 375 lb. pressure, their problem was prevention of corrosion and analcite scale formation. The treatment involved use of phosphoric acid, soda ash and sulphite. They had not gone to as much as 1:1 ratio of alkalinity to PO_4, let alone the 1:3 alkalinity sulphate ratio recommended by A.S.M.E. and no trouble had been encountered. Of the make up water, 40 per cent was condensate return and 60 per cent new water, and the heavy duty boilers had been closely watched for difficulties. In summing up, Mr. Frisk said that the major factors in boiler control were (1) Know the composition of the feed water; (2) Obtain the services and counsel of experts with experience; (3) Install proper equipment to effectively condition the water; (4) Adequate control of treatment by routine sampling and analysis. Above all, it should be recognized that there was no "dope", "pill" or "prescription" which could be accepted as a "balanced ration" for boiler conditions in general.

"Softening and Deferrization of Well Water Supplies" by N. D. Doane, Sales Engineer, The Permutit Company, Charlotte, N. C.

Mr. Doane reviewed the specific advantages of water softening by the lime or lime-soda process and base exchange (zeolite) process, or a combination of both. In North Carolina well supplies, calcium hardness was the most important and magnesium next and iron the least prevalent of these objectionable constituents. He discussed the mechanism of the zeolite process, economy of installation, simplicity of operation (now automatically controlled) and advantages of the elimination of chemical dosage control and sludge handling problems. The zeolite process of iron and manganese removal was in reality not an exchange process but rather a process involving plating out of iron or manganese on the surfaces of the zeolite. New to many, was the fact that in zeolite softening sea water was now being successfully used in regenerating the zeolite beds, thus eliminating the major operating expense—salt purchase and preparation of regenerating brine.

1. J. L. Perkins, Director Public Works, High Point; 2. P. A. Peterson, Distr. Mgr., Neptune Meter Company, Atlanta; 3. D. S. Hair, Supt., Water and Sewage, Elizabethtown; 4. E. A. Sigworth, Industrial Chemical Sales Company, New York City; 5. John F. Strickland, Chemist, Dunn, N. C.; 6. John Woodson, Mgr. Sales, Lynchburg Foundry Co., Lynchburg, Va.; 7. "Bill" Rapp, Jr., Mueller Brass Co. of Port Huron, Michigan, Atlanta.

Garbage and Refuse Disposal

The first of two papers dealing with refuse and garbage disposal was presented by Harrison P. Eddy, Jr., of Metcalf and Eddy, Engrs., Boston, Mass., who reviewed the relationship between **"Refuse Disposal and Public Health."** The various diseases and plagues traced to rats, vermin, fleas and flies were enumerated and the likelihood, and circumstantial evidence, that refuse dumps were breeding grounds was discussed. Mr. Eddy concluded that, although delinquent and unsanitary refuse disposal could be held responsible for much disease, probably the more important universal consideration was that of decency and good municipal housekeeping rather than the public health problem.

In the discussion period it was stated by Mr. Eddy that between 600 and 700 American cities now practiced garbage and refuse incineration. Recently built small plants had combined under one roof garbage and refuse destruction with sewage treatment, thus reducing costs of construction, operation, and maintenance. It was pointed out by Mr. Cohn that children had been poisoned or made seriously ill by picking up edibles from public dumps and eating them. Certainly, in the South particularly, fly and vermin breeding around dumps must be as important a consideration, as was the stench.

"Sewage and Garbage Disposal—Related Municipal Functions" by Morris Cohn, Editor, "Municipal Sanitation" and City Sanitary Engineer, Schenectady, New York.

Mr. Cohn in this, as in his previous papers on the possibilities and practicability of disposing of municipal garbage through sewers and sewage treatment process, reviewed recent developments in this direction. Pointing out the great similarity between sewage and garbage solids, he criticised the smug assertion of some sanitarians that garbage does not belong in sewers.

Mr. Cohn discussed the possible methods of sewer disposal of ground garbage through central grinding stations, household grinding machines, grinding at sewage treatment plant. Later, the combination refuse incineration-sewage treatment plant. The advantages of central grinding stations was emphasized as eliminating expensive long hauling of the garbage. The household grinder was primarily a convenience to the owner but reduced garbage haulage. Plant grinding had the advantage of making it possible to dispose of the pulp direct to digesters, to the sewage flow, or by dewatering and incineration, at will. For small towns combination sewage treatment and refuse incineration works had a special appeal, since the haul was short and the operation economical and flexible.

Although numerous investigations on a laboratory or semi-plant scale had shown the practicability of digesting garbage with sewage solids, the 7-month full plant scale demonstration of grinding and putting all of the garbage through the Indianapolis sewage treatment plant provided outstanding proof that the process was both feasible and economical. (See Water Works and Sewerage—May 1936—"The Effect of Ground Garbage on Sewage Treatment Plant Operation" by Calvert and Tolman.) The next most important large demonstration was that of Baltimore in 1933 as a measure to relieve incinerator plants during peak load seasons.

In discussing equipment, Mr. Cohn cited hammer type mills with capacities of 6 to 60 tons per hour and shear type mills with capacities of 6 to 24 tons per hour. For household grinding, many "G.E." grinders had been installed, and were already legalized in Los Angeles and Riverhead, L. I. As to plant grinding of garbage, 9 plants had been equipped for garbage shredding and incineration with sludges. There were five or more combination plants involving rubbish and garbage incineration along with sewage treatment, as interlocking operations.

Mr. Eddy in discussion pointed out that incinerators were now being geographically located in large cities so as to preclude long hauls heretofore considered necessary.

Mr. Enslow called attention to the new Providence, R. I., garbage-rubbish incineration plant, wherein power was being developed sufficient to operate the activated sludge treatment plant adjoining and also a nearby main pumping station. He had visited the plant which was more nearly free from odor and dust than any he had ever seen. He asked Mr. Eddy's opinion of such a plant. To this Mr. Eddy replied that the plant had a capacity of 175 tons per day, was only 1 mile from the City Hall; had the advantage of operating at uniform temperature; wrapped garbage and rubbish were handled separately but fired in proper ratio. Other garbage-rubbish incinerators producing power were in New York City, Rochester, N. Y., Manchester, N. H. A study at Buffalo had shown such power production to be uneconomical in the face of low electric rates.

Asked for his experiences at Durham, Mr. Piatt said that the limited demonstration with a part of the city's garbage did not justify much comment. However, no difficulty resulted in sewer or at the treatment works and gas production increased during grinding and sewer disposal of a part of the municipal garbage.

Replying to questions, Mr. Cohn said that household grinding of garbage had given no grease cloggage trouble in house laterals or service lines. The "G.E." grinder handled bones satisfactorily, cost $130.00 plus an installation charge of about $20.00.

1. Z. N. Holler, Mathieson Alkali Works, Charlotte; 2. "Bob" Luther, Supt. Filtration, Elizabeth City; 3. J. L. Hodgson, A. P. Smith Manufacturing Co., Atlanta; 4. G. F. Kirwan, Homelite Corporation, Atlanta; 5. J. H. Henderlite, Jr., City Chemist, Gastonia; 6. A. W. Wilson, Station Engineer, Wilmington; 7. P. D. Davis, with Wm. Piatt Engr., Durham; 8. Stanley Kappe, Sanitary Engineer, Chicago Pump Co., Philadelphia, Pa.

"Public Health Engineering Works During the Ohio River Flood" was told by D. S. Abell, Prin. Asst. Engr., North Carolina State Department of Health, and amplified by Dr. M. H. Thompson and E. W. Kearney, also having done flood duty. Mr. Abell in an interesting review recited many novel and trying experiences, several human interest stories of the flood, and the lessons learned. [We regret that more of Mr. Abell's interesting talk cannot be given, but space limitations prevents it.—Ed.]

The Clinics

The closing hour of the meeting was devoted to the "Clinic," to which operators were invited to bring their troubles for discussion and diagnosis—if possible.

The "Water Clinic" was in charge of A. O. True; the "Sewage Clinic" was, without doubt, ably conducted by Morris M. Cohn but unfortunately, because of the lateness of the hour when the "Clinic" was finally reached, this reporter had to leave to keep an appointment.

Localized Corrosion Troubles

McKean Maffitt, Supt. Water and Sewerage, Wilmington, exhibited specimens of badly corroded and rust choked sections of service lines which, being so much more pronounced in the zone immediately adjacent to brass, bronze or copper fittings, valves or cocks, pointed

suspiciously to the fact that a form of electrolytic (battery) action had been set up at the point of contact between the two dissimilar metals. The same effect had been noted at the bronze and iron juncture of hydrant valve-stems. In respect to the point of contact between brass corporation cocks and walls of C. I. pipe the same effect was noticeable on the inside of the main. Unless the end of the corporation extended well through and into the main the deposition of rust would build over and choke the port through the cock. Mr. Maffitt exhibited a section of tar or asphaltic pipe lining, taken from C.I. pipe laid in 1881, which had been heavily encrusted with tubercules although the pipe behind the lining had not been more than "etched"—definitely not pitted to any appreciable degree.

Wm M. Piatt (Durham) was of the same opinion as Mr. Maffitt regarding the troubles at points of juncture between dissimilar metals, and cited his own experiences to show that stray electric currents could not have been responsible. In another instance the brass rod, connecting bronze shut-off valve and copper float in a toilet flush tank, would lose its "backbone" in short time. Since substituting a float of Bakelite, for the copper, the brass rod seemed to be retaining its vitality indefinitely.

There was a suspicion in the minds of some of the members that the shallow crater-like tubercules on the surface of the bituminous-dip pipe lining were laid down during the 56 years of pipe service by biological action such as the crenothrix bacteria and other forms known as iron-mongers.

Dr. Borgmann (National Tube Company) expressed the opinion that the pipe dip was porous and the tubercules were very old, consisting of some iron coming through the lining long ago and then more deposited by iron bacteria, capable of taking iron from the water. When considering it a deposit of 56 years, it was impressively small. In respect to the iron oxide (rust) deposits being pronounced at points of dissimilar metal junctures, Dr. Borgmann thought that the corrosion had taken place over a distance, but that there had been intensification of *rate* of corrosion at the two metal junctures.

Richard V. Ford (Ford Meter Box Co.) pointed out one weakness in the scheme of screwing in corporation cocks to project into the mains. He referred to the trouble to be encountered when attempting to clean such mains with the usual water propelled spring-tooth scraping machine, or "rabbit" as it is called. He wondered if possibly there was not some actual electrolysis effect responsible for the localized corrosion—referring to the recent observations and disclosures in A.W.W.A. Committee meetings, to the effect that grounding of house wiring or radios, and the like, has been responsible for localized service line and meter corrosion.

Mr. Maffitt, however, stated that he could find no correlation to indicate that stray currents produced the electrolysis. Further, Mr. Piatt's observations more or less confirmed the theory of the wet battery effect produced by electric-couples of abutting metals with differing potentials, such as zinc, copper, brass, iron.

(We wonder if ground water, or percolating water from rains or lawn sprinkling, or the solution created by pipes sweating in contact with soil—all being productive of a stronger electrolyte than the water flowing through the pipes—is not the more responsible for the galvanic action and localized intensity of corrosion and rust choking. The latter being due to the continuous passage of dissolved oxygen by those points where the iron literally "flows" from the pipe in the form of oxygen grabbing ferrous ions.—Ed.)

Fifty Firms to Exhibit at New England Convention

To date the fifty firms listed below have taken exhibit space for the 1937 Convention of the New England Water Works Association, to be held at Poland Springs, Me., Sept. 21st-24th, and there will probably be additions to the list before the Convention opens.

Exhibitor	Address
The American City Magazine	New York City, N. Y.
Bingham & Taylor Corp.	Buffalo, N. Y.
The Barrett Company	New York City, N. Y.
F. S. Brainard & Company	Hartford, Conn.
Builders Iron Foundry	Providence, R. I.
Geo. A. Caldwell Co.	Boston, Mass.
Carson-Cadillac Corp.	Birmingham, Ala.
Chapman Valve Mfg. Co.	Indian Orchard, Mass.
Chicago Bridge & Iron Co.	Chicago, Ill.
Crane Company	Chicago, Ill.
Darco Corporation	New York City, N. Y.
Eddy Valve Company	Waterford, N. Y.
The Edson Corp.	South Boston, Mass.
Engineering News-Record	New York City, N. Y.
Farnan Brass Works Co.	Cleveland, Ohio
The Foxboro Company	Foxboro, Mass.
Hays Manufacturing Co.	Erie, Pa.
Hersey Manufacturing Co.	South Boston, Mass.
Homelite Corporation	Port Chester, N. Y.
Hydraulic Development Corp.	New York City, N. Y.
Industrial Chemical Sales Div. (W. Va. Pulp & Paper Co.)	New York City, N. Y.
Johns-Manville	New York City, N. Y.
The Kennedy Valve Mfg. Co.	Elmira, N. Y.
The Leadite Company	Philadelphia, Pa.
Lock Joint Pipe Co.	Ampere, N. J.
McWane Cast Iron Pipe Co.	Birmingham, Ala.
Mueller Company	Decatur, Ill.
National Meter Co.	Brooklyn, N. Y.
National Water Main Cleaning Co.	New York City, N. Y.
Neptune Meter Co.	Long Island City, N. Y.
The Pardee Engr. Co.	Long Island City, N. Y.
Phoenix Meter Corp.	Prince Bay, Staten Island, N. Y.
Pitometer Co.	New York City, N. Y.
Pittsburgh-Des Moines Steel Co.	New York City, N. Y.
Pittsburgh Equitable Meter Co.	Pittsburgh, Pa.
Proportioneers, Inc.	Providence, R. I.
Public Works Magazine	New York City, N. Y.
Public Works Supply Co.	Lynn, Mass.
Red Hed Mfg. Co.	Boston, Mass.
Rensselaer Valve Co.	Troy, N. Y.
Ross Valve Mfg. Co., Inc.	Troy, N. Y.
The A. P. Smith Mfg. Co.	East Orange, N. J.
Thomson Meter Corp.	Long Island City, N. Y.
United States Pipe & Fdy. Co.	Burlington, N. J.
Wailes Dove Hermiston Corp.	New York City, N. Y.
Wallace & Tiernan Co., Inc.	Newark, N. J.
Warren Pipe Company of Mass., Inc.	Boston, Mass.
Water Works Engineering	New York, N. Y.
Water Works & Sewerage	New York and Chicago
R. D. Wood Company	Philadelphia, Pa.

(Signed) Chas. H. Becker, Chairman Exhibit Committee.

▼

Minneapolis to Centrifuge Fine Screenings

Authorities of the Minneapolis-St. Paul Sanitary District have recently placed an order for one of the new American high capacity centrifuges to be installed for dewatering ground screenings at the Twin-Cities Sewage Treatment Works now nearing completion.

The centrifuge will be called upon to turn out a cake with 70 per cent moisture content and handle between 4,100 and 8,200 pounds of dry solids per day in the form of wet screenings containing between 15,000 to 35,000 gallons of water. The contract was awarded American Centrifugal Corp. of New York City on the basis of a guarantee to produce a cake averaging 70 per cent moisture and to handle the whole of the screenings load with a single machine.

The Editor's Comments

Two Presidents

"NOTHING in this world is sure except change; and, water works associations must change or be left behind"—is a succinct statement made by the president of the New England Water Works Association on a prominent page in this issue.

In discussing the timely and important questions—"Why Water Works Associations; How Can They Best Serve?"—President HARRY U. FULLER has broached a matter of consequence to every one directly, or indirectly, concerned with water works operations. To every water works association it is a subject of major import to members; and likewise, to officials who would see that such associations justify their continued existence and go forward in attaining measurable accomplishments and a gain in strength for the good of the profession at large, and members in particular.

Definitely, the two major American associations serving the water works field have problems now reaching beyond those of earlier years when educational and technical features were stressed to the exclusion of practically all else. In this day of organized efforts of workers in many fields, with demands for greater recognition and fairer division of gain between capital and labor, and with old age security provided for workers in private industry, where else can the water words operator more expectantly look for movements in the direction of gaining for him more adequate recognition, advancement and security, than to the established associations of which he is (or should be) a member?

Leaders in the two major water works associations in America—the American and the New England—recognize the desire to bring within the scope of their activities a new objective—that of advancing the social status and security of the water works employee. In consequence, studies are under way to evolve methods and procedures most likely to bring about the deserved higher appreciation of what the local water utility means to the community. And, hand-in-hand with it, the higher recognition of those responsible for water supply service, and a fairer share of the good things of life, plus security of position and insurance against want when disability or obsolescence overtakes faithful employees. Than this: how *better* could water works associations strive to serve?

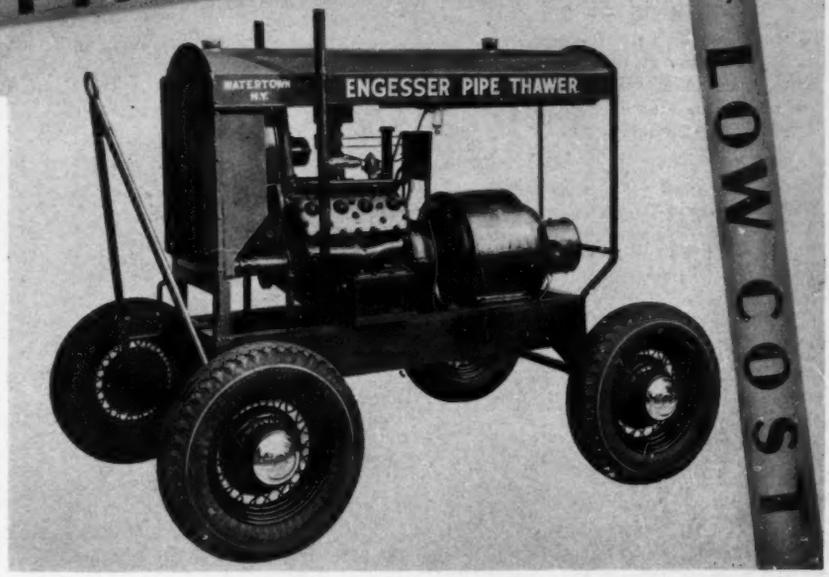
President FULLER rightly states that "the association rendering the highest service to the largest proportion of utilities in its territory, and the most educational service to utility operators, will be the most successful." Further, "water works associations survive and advance, primarily because they are educational." It seems proper and timely, however, to consider the broadest possible interpretation of what is meant by "education" and thereby extend such beyond the ranks of the membership, and preach in the highways and byways of the communities. Yes, we mean extending the educational aspects to reach the consumer and the public generally, especially the younger public, who may come to realize that water works management and operation is more than the job of a plumber; that it deserves more recognition than that accorded municipal electric or gas utility management, which in general enjoys a freer hand than does water works management and suffers less interference. In addition, we mean the educational aspect to reach the legislator, who may come to realize that it is wisdom to evolve licensing acts to insure a grade of water utility operation that insures safety along with soundness of economy. Also, to reach the local politician who may be brought to realize that he is confronted with the necessity of seeking elsewhere for equally proficient (licensed) operators if he entertains any idea of a water department "shake-up" when he steps into office. Then, too, if water works associations can "educate" governing bodies to consider employees of publicly owned utilities as of the same flesh as privately employed operatives, the establishing of pension and retirement systems for their protection may be the reward of a high service by the association.

President FULLER, who speaks as the result of observation and experience, sees the need for extending the services of water works associations to the greatest numbers. Toward this end he advocates the holding of more frequent meetings, and these at points more easily and less expensively reached by operators of the numerous smaller water works. This same idea has likewise been voiced by EUGENE F. DUGGER, president of the American Water Works Association, in his acceptance speech when inducted into office. Again, last month, he emphasized this thought before the North Carolina Section when he stressed as one objective of the association—"the greatest possible service to the greatest possible numbers." To attain this end, the matter of serving a greater number of members and potential members through increasing their opportunities to reach meetings, was President DUGGER's uppermost thought when he advocated the establishment of an increased number of A.W.W.A. Sections, in that "a greater attendance may be had at meetings and a much closer contact be maintained between members." To this same end—"there should be a closer coordination with water conferences and short schools"; and, to broaden the association's service to the greatest number, Mr. DUGGER announced that the matter of establishing some form of Affiliate Membership in A.W.W.A. is now under serious consideration, the underlying motive being the desire of serving greater numbers of those men least able to carry a full membership.

It is apparent that the two presidents, DUGGER and FULLER, have voiced the need for better serving operators in the smaller plants and, likewise, the less well paid employees in the larger plants, by holding more readily reached and more frequent meetings, conferences, short schools. A class of membership which will make more readily available an association service to the most needful of it, but least able to pay the full membership dues will, we believe, be a major step in the right direction. Those who have observed the effectiveness of the well attended monthly meetings of President FULLER's New England association, and his Maine Water Utilities Association, and what these have done for members, will need no argument to be convinced of the correctness of the recommendations of these two progressive association presidents—Virginia's DUGGER; Maine's FULLER.

The American association can point with satisfaction to its record gain of better than 325 new members since the first of the year. However, with the needed splitting up of those sections now ineffectively attempting to serve too greatly extended areas; the establishment of new sections, manned with aggressive secretaries; the affiliation of or consolidation with existing state groups, not now connected with A.W.W.A.; the establishing of some form of membership within the reach of the greatest numbers of operators, there should result a marked growth in membership, a greater income and activity. Therewith, the first marked stride by water works associations will have been made in providing *"Greatest possible service to the greatest possible numbers."*

Efficient PIPE THAWING at LOW COST



EFFICIENT pipe thawing at low costs are reported to us by the many users of the Engesser Pipe Thawer. On the market since 1924 these machines have rendered a real service to many Water Departments throughout the country.

Simple in operation. Powered by the latest type Ford V-8 Heavy Duty Truck engine. Low voltage never in excess of 100 volts, eliminates all possibility of electric shock.

Consider the need of this important machine—before winter sets in. Additional information upon request.

Engesser Electric Manufacturing Company, Inc.
Watertown, New York

LFC

21 Miles of "Lynchburg" High Tensile

Twenty-one miles of "Lynchburg" 36-inch High Tensile Cast Iron Pipe now serves the City of Lynchburg, Va., with an abundant supply of pure mountain water . . . A project of major proportions — with every piece of pipe delivered on time. . . . For quick estimates on Cast Iron Pipe and Special Fittings regardless of size or shape, write, wire or phone "Lynchburg."

Bell and Spigot Pipe and Fittings. From 4" to 54".
Cast Iron Flanged Pipe. From 3" to 84".
Cast Iron Flanged Fittings & Flanges. From 1" to 84".
Super-de Lavaud Centrifugal Cast Iron Pipe.

Special Iron Castings for the Chemical Industry

Lynchburg Foundry Co.
General Office: Lynchburg, Virginia

Peoples Gas Building
Chicago, Ill.

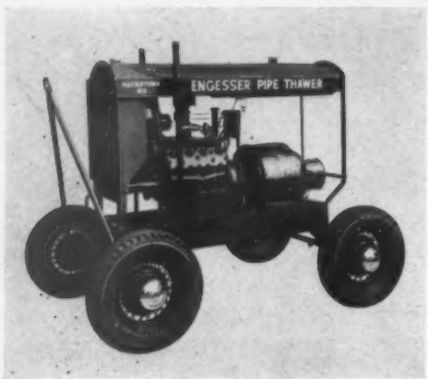
50 Broad Street
New York, N. Y.

EQUIPMENT NEWS

Improved and Simplified Thawing Machine

Engesser Electric Manufacturing Company of Watertown, N. Y., have recently announced simplification and improvements of their well known Pipe Thawer, developed and introduced in 1924.

One of the outstanding features is its simplicity of operation and connections; another, its low voltage (top voltage = 100) in order to eliminate hazard to operators and danger to property. The main generator is powered by direct connected



Engesser Pipe Thawer

flexible shaft to a Ford V-8 heavy-duty engine. A speed control governor prevents overspeeds and possible damage therefrom. The generator is of the A. C. type, with maximum capacity of 800 amperes, or 90 volts, to produce the current flow required for the job at hand. This somewhat exceptional capacity and flexibility has been attained through improvements based on long experience in the field.

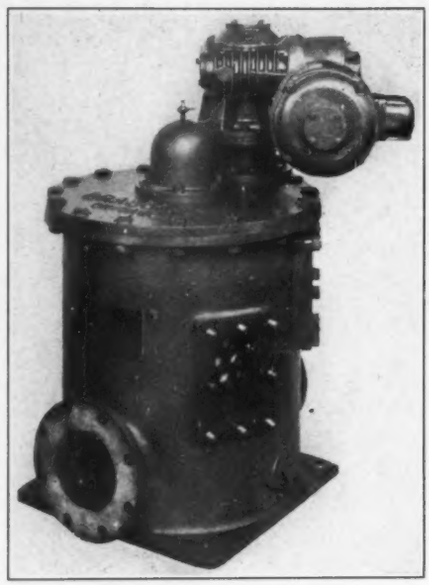
The improved Engesser Pipe Thawer comes mounted in two ways. One model, for conveying on trucks, is mounted with three cast-iron wheels (three point suspension), thus avoiding bearing binding. The other, as pictured, is the more adaptable mobile-trailer model, with easy running pneumatic wheels. Many more details, performance records and list of users are given in Engesser's new circular—"Modern Simplified Pipe Thawing." For a copy, address Engesser Electric Mfg. Company, Watertown, N. Y.

▼

Brassert Automatic Strainer

H. A. Brassert and Company, of Chicago and London, long known in the industrial field as engineers and contractors, are offering the "Brassert Automatic Strainer" for continuously removing suspended solids from water, sewage, industrial wastes or other liquids. It is automatically self-cleansing, by the backflow of roughly 5 per cent of the effluent.

The Brassert strainer consists essentially of a conical cylinder, revolving at desired rates of speed in a cast-iron housing. The cylinder is studded with easily



Brassert Strainer

removable perforated discs of non-corrodible glazed porcelain. The size of perforations are selected for the job at hand. The liquid flows through the strainer discs to the interior, and thence to the effluent port. Disc cleaning is performed by continuous reverse flow of roughly 5 per cent of the effluent through the discs while passing a back-wash port. Capacity of the strainer is varied with pressure on the cylinder and speed of revolutions. For further details address H. A. Brassert & Co., 310 South Michigan Ave., Chicago.

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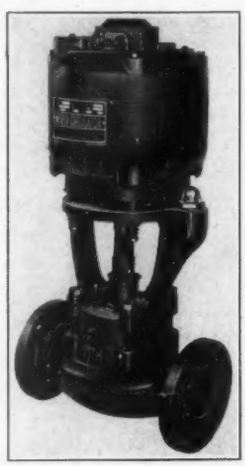
New Hot Water Circulator

The Minneapolis-Honeywell Regulator Company has introduced a new precision built, oil reservoir lubricated and packless-sealed "Water Circulator."



New Hot Water Circulator

The new Circulator is primarily intended for speeding up circulation through hot water heating coils, such as used in sludge digesters, or heating systems in buildings. It may be used alone or in conjunction with a M-H Flow Valve to provide fully automatic temperature control of the circulated water or other liquids. It is quiet in operation; is leak-proof, due to the exclusive M-H Packless Seal which prevents oil leakage into the system; has standard thermal overload cut-out built in; requires only low starting current.

The Circulator has a stainless steel drive shaft; bearings of high grade bronze, and is scientifically and trouble free lubricated from the oil reservoir built into the unit. It is available in sizes to fit 1, 1½, 2 and 3 inch pipe and may also be had for voltages and cycles other than the standard 110 volt, 60 cycle current.

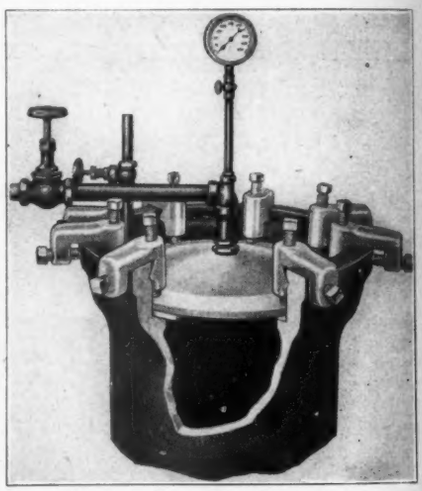
For a descriptive circular giving details and specifications, address Minneapolis Honeywell Regulator Company, Minneapolis, Minn.

▼

Test Plug for Testing Water Mains

The new "Hold-Firm" Test Plug was developed and perfected by the Test Plug Mfg. Company of Niles Center, Ill., for testing the tightness of new water mains, or the strength of fittings, reclaimed pipes, or new pipes.

The accompanying illustration is essentially self descriptive of the "Hold-Firm" plug. Consisting of a steel plate, a rubber gasket, and the requisite number of clamps, its construction and application could hardly be simpler. These plugs are guaranteed to withstand 300 lbs. hydrostatic pressure and come tapped and threaded for pressure water connection and gage, and air outlet and pressure release connection. The same clamps are used on the various sizes of pipes, there simply being



"Hold-Firm" Test Plug

more needed for the larger sizes of plates to provide a clamp spacing of 5 inches or less.

The "Hold-Firm" Plugs prove useful in repair work also. With their use it is evident that pressure can be more promptly restored on either or both ends of the line cut, thus allowing more leisure in making the change or repair, and consequently a better job with less disturbance to service and fire protection. The new "Hold-Firm" Test Plugs come in a slightly different, but equally simple, design for use on spigot ends and on plain end pipes with the same satisfaction.

LANSING, MICH.

36" Dresser-coupled sewage main constructed between pumping station and sewage-treatment plant. Dresser Couplings used at every connection —for ease of installation, and pressure-tight joints.

Why are SEWAGE ENGINEERS CHOOSING DRESSERS?

Cross section of Dresser Style 38 Coupling. Sizes available: ¾" I.D., up.

Men who *know* joints are the ones most likely to specify Dresser Couplings. Briefly, the advantages are: (1) Permanent Tightness—proved for 50 years, on 150,000 miles of pipe; (2) Flexibility; (3) Simplicity; (4) Strength; (5) *True* Economy.

Investigate these advantages! Dresser Catalog No. 36 explains everything clearly. Send for this "handbook," *now*—before you install that next air, water, sludge, or outfall line! . . . S. R. DRESSER MFG. COMPANY, BRADFORD, PA. . . . . *In Canada:* Dresser Mfg. Company, Ltd., 60 Front St., W., Toronto, Ont.

% CHEMICAL FEEDERS %

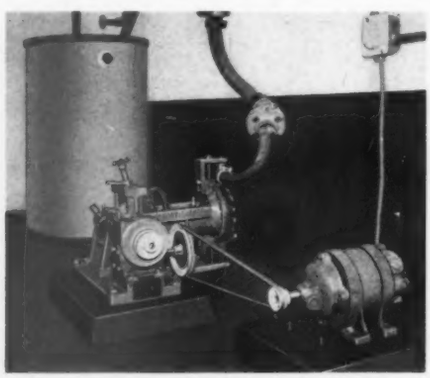
Entrance to Sewage Treatment Plant, Elmira, N. Y.

"THE LITTLE RED PUMP"
makes friends at Elmira.

Proportioneers' Ferr-O-Feeder, affectionately nicknamed "The Little Red Pump" at Elmira, received this praise: "On every sewage plant I've previously put in operation, ferric feeding was the bane of my life. Clothes, hands, and the plant in general, were spattered with ferric chlorite, and making adjustments was a mess. Using "THE LITTLE RED PUMP" on this job took much of the grief out of ferric treatment.

Using %Proportioneers' equipment takes much of the grief out of every chemical feeding job—whether it's solution feeding or controlling dry feeders in response to flow.

Write for New Bulletin "RED".



"The Little Red Pump" installed at Elmira.

BOOTH 49—N.E.W.W.A.—
POLAND SPRINGS
BOOTH 73—N.P.H.A. — NEW YORK
A chance to see just what we have to offer awaits you at our booth.

% **PROPORTIONEERS** %
Inc.

Associated with Builders Iron Foundry

9 N. Codding Street
PROVIDENCE, R. I.

New Carbide Lantern

A new carbide lantern for municipal and industrial use has recently been announced by the National Carbide Corporation.

The improved lantern is the result of manufacturing experience and study of field conditions to develop an ideal carbide lantern, the result being a safe lightweight 8 hour lantern. It is equipped with safety flame protector, heat resisting glass lens and porcelain burner tips. It has an insulated handle to protect the workman, positive water feed control, and a patented rear light of any desired color. Other improvements have added durability and dependability.

A descriptive folder and prices may be obtained by addressing the National Carbide Corp., Lincoln Bldg., New York City.

▼

WITH THE MANUFACTURERS

Shelgren to Represent Dresser in Michigan

W. L. Shelgren

S. R. Dresser Mfg. Co., of Bradford, Pa., well known manufacturers of flexible pipe couplings and pipe line repairs, have recently announced the appointment of W. L. Shelgren as their sales representative for the State of Michigan, except Detroit. To his credit are 11 years of service with Dresser Company, and a varied experience in pipe joint engineering. Mr. Shelgren's headquarters are at the home office in Bradford, Pa.

▼

Diamond Alkali Makes G. S. Cooper Vice President

G. S. Cooper

L. G. Flaccus, President, has just announced the election of George S. Cooper as Vice President in Charge of Sales for Diamond Alkali Company of Pittsburgh, Pa. Mr. Cooper succeeds F. G. Lancaster, who recently resigned from this position, after 21 years with the company.

▼

$469,000 Contract for Tallman's Island Sewage Equipment Awarded to Worthington

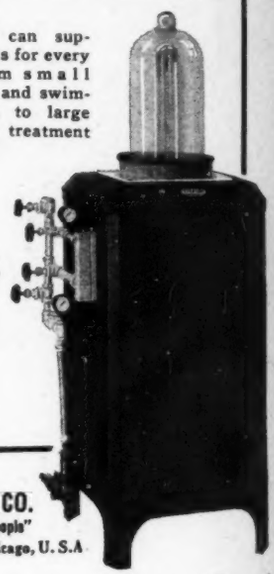
The New York City Department of Sanitation has awarded to Worthington Pump and Machinery Corporation a contract for pumps and gas engines for the Tallman's Island Sewage Treatment Works, totaling $469,000. This project is being pushed through to completion, in advance of schedule, to be in operation before the N. Y. World's Fair opens.

The contract calls for four centrifugal pumps, two with a daily capacity of 15 million gallons each, and two of 35 million gallons each. Worthington will also furnish eight gas engines ranging from 180 to 800 horsepower. These engines will operate on sludge gas developed at the plant. Four of the engines will drive the centrifugal pumps and the others, rotary blowers.

Announcing
The New **EVERSON**
Type "R" Chlorine Sterilizer

HERE at last is the perfect chlorine sterilizer featuring the exclusive EVERSON *micro-control*, absolutely accurate feature, combined with the other proven EVERSON features including: Automatic Gas Absorber, Automatic Venting, and the Automatic Vacuum Break which protects against Back-Flooding.

EVERSON can supply capacities for every need—from small water works and swimming pools, to large sewage treatment plants.



Write for New Bulletin

EVERSON MFG. CO.
"The Swimming Pool People"
233 W. Huron St., Chicago, U. S. A.

▼

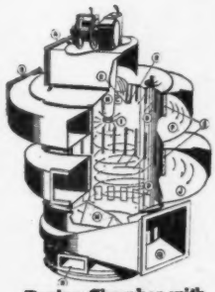
Fuller Company Announces Changes in Personnel

Fuller Company, manufacturers of "Airveyor" pneumatic conveying systems, of Catasauqua, Pa., announce the following changes in district office personnel.

To the San Francisco office Mr. C. C. Kaesemey, as Service Engr. Oldest in years of service as a Service Engr., A. W. Quick, temporarily assigned to the Pacific Coast will return to headquarters at Catasauqua. Mr. E. A. Hamer will be transferred from the Chicago office to San Francisco October 1st, as assistant to J. M. Alonzo, Manager. Mr. A. C. Vaughan moves to the Chicago office as assistant to H. S. Sayre, Manager, and F. G. Terwilliger continues as Service Engineer in the Chicago district.

Split-second DRYING

at low operating cost



(Drying Chamber with Centrifugal Atomizer – 18,000 R.P.M.)

Learn the facts about

Spray Drying

before you decide on drying equipment.

Send for Bulletin No. 3

BOWEN

RESEARCH CORPORATION
GARWOOD, NEW JERSEY

Gold Medal Award of Merit

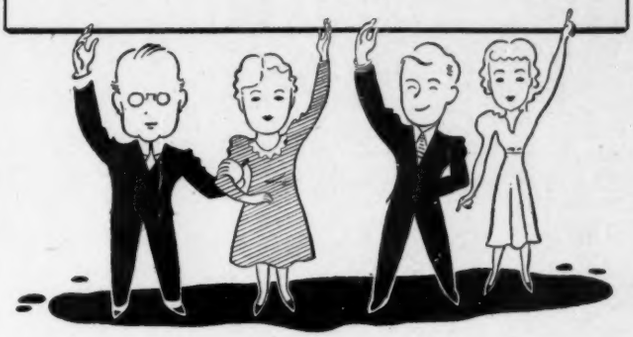
—evidence from overseas that V-K-K Deep-Well Turbine Pumps command an international market. WATER—dependably—since 1864.

VICTOR KIMBALL PUMPS KROGH

VICTOR EQUIPMENT COMPANY
KIMBALL-KROGH PUMP DIVISION

1010 East 62d Street, LOS ANGELES
515 Harrison Street, SAN FRANCISCO

A PERMUTIT WATER SOFTENER



wins united support

A municipal water softener makes life better for every member of every family. Clothes washing, dishwashing, scrubbing, cleaning—all are easier with soft water.

Soft water is better for health, too; benefits skin, hair; makes bathing a real pleasure. Good for babies, especially. Physicians say hard water causes chafed legs and sour-smelling bodies of infants.

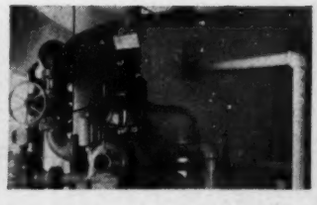
IMPORTANT: Soft water helps cut living costs. Saves soap; laundered clothes and linens fray less, last longer; protects plumbing, saves repair bills; cuts fuel costs; improves cooking; saves coffee.

Permutit municipal water softening projects win united support, help everybody, and pay their way. Other Permutit equipment removes bad taste, odor, iron, dirt or corrosive qualities from water supply. Write for information, references, estimates. Address your inquiry to The Permutit Company, Dept. G1, 330 West 42nd Street, New York, N. Y.

Permutit

WORLD'S LARGEST SPECIALIST IN

Water Conditioning



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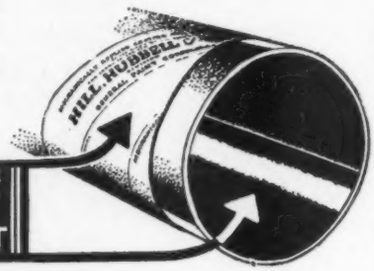

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MEETINGS SCHEDULED:

Sept. 27-28—MANDAN, N. D. (Lewis and Clark Hotel).
North Dakota Water and Sewage Works Conference (Annual Convention). Sec'y-Treas., M. D. Hollis, State Department of Health, Bismarck, N. D.

Sept. 30-Oct. 1—SCHENECTADY, N. Y. (Hotel Van Curler).
New York Section, A. W. W. A. Sec'y, R. K. Blanchard, Neptune Meter Co., 50 W. 50th St., New York City.

Oct. 1-2—WORCESTER, MASS. (Hotel Bancroft).
New England Sewage Works Association. Sec'y-Treas., F. W. Gilcreas, N. Y. State Dept. Health, Albany, N. Y. (Annual Meeting with Manufacturers' Exhibits.)

Oct. 4-6—ATLANTA, GA. (Atlanta Biltmore Hotel).
American Public Works Association (Congress). Executive Director, Frank W. Herring, 850 E. 58th St., Chicago, Ill.

Oct. 4-5—SIOUX FALLS, S. D.
South Dakota Water and Sewage Conference (Annual Meeting). Sec'y, W. W. Towne, Sanitation Board, Pierre, S. D.

Oct. 5-8—NEW YORK CITY, N. Y. (Hotel Pennsylvania).
American Public Health Association (Annual Convention). Executive Sec'y, Dr. Reginald D. Atwater, 50 W. 50th St., New York City. (On Oct. 8, Joint Session of New England, New York State and New Jersey Sewage Works Associations with Public Health Engineering Section of A. P. H. A., Hotel Pennsylvania Roof Garden.)

Oct. 5-8—NEW YORK CITY, N. Y. (Hotel Pennsylvania).
Conference of State Sanitary Engineers (Annual Convention). Sec'y-Treas., R. E. Tarbett, U. S. Public Health Service, Washington, D. C.

*Oct. 7-9—ST. PAUL, MINN. (Hotel St. Paul).
Minnesota Section, A. W. W. A. Sec'y-Treas., R. M. Finch, W. & T. Co., 416 Flour Exchange, Minneapolis, Minn.
*(NOTE: Due to lack of proper hotel accommodations these new dates supersede those announced earlier, viz., Oct. 28-30.)

Oct. 13-15—ATLANTIC CITY, N. J. (Haddon Hall).
Pennsylvania Water Works Association (Annual Meeting). Sec'y, Dr. F. Herbert Snow, 327 Telegraph Bldg., Harrisburg, Pa.

Oct. 15-16—ELMIRA, N. Y. (Mark Twain Hotel).
New York State Sewage Works Association (Fall Meeting). Sec'y-Treas., Arthur S. Bedell, State Dept. Health, Albany, N. Y.

Oct. 15-16—ATLANTIC CITY, N. J.
New Jersey Section, A. W. W. A. Sec'y, P. S. Wilson, 325 Washington St., Glen Ridge, N. J.

Oct. 18-21—GALVESTON, TEXAS (Hotel Galvez).
Southwest Section, A. W. W. A. (Annual Meeting). Sec'y-Treas., L. A. Quigley, Supt., Water Dept., Fort Worth, Tex.

Oct. 18-21—NEW ORLEANS, LA. (Hotel Roosevelt).
International City Managers' Association. Executive Director, Clarence E. Ridley, 850 E. 58th St., Chicago, Ill.

Oct. 19-20—CINCINNATI, OHIO (Netherland Plaza Hotel).
Ohio Conference on Sewage Treatment (Annual Convention). Sec'y, Bruce M. McDill, Dept. Health, Columbus, Ohio.

Oct. 21-22—CINCINNATI, OHIO. (Netherland-Plaza).
Ohio Conference of Water Purification. Sec'y, Thos. R. Lathrop, Ohio Dept. of Health, Columbus, Ohio.

Oct. 20-23—SACRAMENTO, CALIF. (Senator Hotel).
California Section, A. W. W. A. (Annual Convention). Sec'y-Treas., C. M. Hoskinson, 1140 43rd St., Sacramento, Calif.

Oct. 21-22—ST. PAUL, MINN. (Hotel Lowery).
Central States Sewage Works Association. Sec'y, W. H. Wisely, State Dept. of Health, Springfield, Ill.

Oct. 21-23—FAIRMONT, W. VA. (Hotel Fairmont).
West Virginia Conference on Water Purification. Secy. J. B. Harrington, Engineering Division, State Department Health, Charleston, W. Va.

April 25-28, 1938—NEW ORLEANS, LA.
American Water Works Association. (Annual Convention). Executive Sec'y, H. E. Jordan, 29 W. 39th St., New York City.

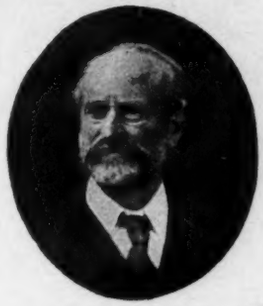
CATALOGS AND LITERATURE RECEIVED

[Any of the publications reviewed in this section can be secured from or through Water Works and Sewerage, if such be desirable.]

"The Aero-Filter"—Is the caption of a new bulletin issued by Lakeside Engineering Corp. of Chicago. It presents features of the "Aero-Filter" and advantages of high rate bio-filtration of sewages and wastes, involving the Halvorson-Smith Process, which makes permissible the application of settled sewages to trickling filters at eight times previously accepted standard rates, viz.: 20 to 30 M.G./acre/day. Claims set forth for "Aero-Filtration" are (1) Construction costs no greater than activated sludge plants; (2) Objectionable features of trickling filters eliminated; (3) Superior results to standard intermittently dosed filters of ⅛th the capacity; (4) Depreciation and operating costs less than that of other processes producing equivalent results; (5) Less subject to overloading or trade waste upsets; (6) Requires less operating attention than activated sludge or chemical precipitation processes.

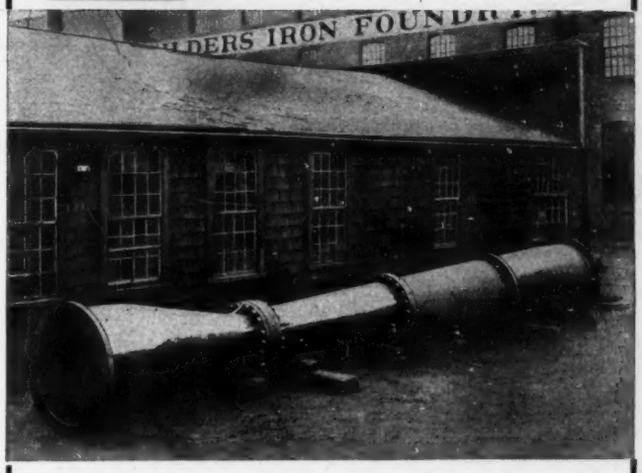
Methods of calculating the required filter dimensions are given, as are methods of routine operation, involving automatic control of return of final (humus) sludge and liquor to dilute crude sewages exceeding 250 p.p.m. BOD.; or, again, whenever the sewage flow drops below the 15 M.G.A.D. specified minimum rate for most efficient aero-filtration. Suggested design and elevations of aero-filtration plants are presented. Specifications are given to cover distribution equipment and ventilating fans. Bulletin No. 107 is easy to read and answers many questions in the engineer's mind concerning "Aero-Filtration." For a copy write Lakeside Engineering Corp., 222 W. Adams St., Chicago.

"Water Works Manual"—Is the caption of a 120-page production from the Youngstown Sheet and Tube Company, put together as a loose leaf binder with handsome blue and gold flexible cover. It opens with a review of the history and service record of steel water pipe in America, since its first manufacture in 1832. Then follows a presentation of the inherent advantages of steel pipes for water mains; methods of handling and laying wrapped and lined pipes; a discussion of corrosion, tuberculation; leakage and breakage of steel vs. competitive pipes; carrying capacity of lined vs. unlined pipes (with illuminating comparative "Capacity Life" diagrams for pipe lines of steel and competitive materials). Methods of applying protective linings and coatings and modern jointing are described. Standards and official pipe specifications are fully presented. In the appendix are many tables of Youngstown Pipe Data, such as dimensions, wall thickness, weights, working pressures—3 to 26 inch diam. Other tables give sleeve type flexible coupling data. Considerable space is devoted to tables of useful miscellaneous hydraulic conversion factors, equivalents, formulae



Clemens Herschel, *Inventor of the Venturi Tube*

1887 · 1937



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constants, engineering data, flow diagrams of value to engineers and superintendents. For a copy of "Water Works Manual" address, Youngstown Sheet and Tube Co. (W. & S. Div.), Youngstown, Ohio.

"Pipe Repair Handbook"—From M. B. Skinner Co., well known manufacturer of pipe jointing and leak repair equipment and devices, of South Bend, Ind., has been received a new "Handbook on Pipe Repairs," for engineers and superintendents. It discusses various kinds of leaks in pipe lines (holes, splits, pitted walls) and joints of various kinds. With ample illustrations it discloses how joint repairs may be made, without service interruption, with Skinner Seal Clamps, available for all sorts of joints; or, with the heavy duty hinged Skinner Emergency Pipe Clamp; or, the light Pressed Steel Economy Clamp for splits, cracks or pit-holes. Also presented are other Skinner accessories such as Service Cut-in Saddles; Valve and Bibb Reseaters and Valve Seat Dressers. For a copy of "Pipe Repair Handbook," address M. B. Skinner Co., South Bend, Ind.

"Universal Feeders"—Is an illustrated bulletin from Omega Machine Co., which is descriptive of the design and operation of the well known oscillating hopper type Omega Dry Feeders for water purification and sewage treatment plants. Amongst the special features discussed are rugged construction, simplicity, accuracy to 3 per cent over wide range, ability to feed non-uniform material without cloggage, wide range hopper capacity, dustless operation, efficient solution pot of large capacity. A list of auxiliary equipment is given as is a partial list of users of Omega feeders. Specifications covering three sizes of feeders are presented in tabulated form. A copy of "Universal Feeders" can be had from Omega Machine Company, 410 Penn Ave., Kansas City, Mo.

"The Peerless Gold-Book"—Seems an appropriate designation of the new 64-page catalog put out by the manufacturers of Peerless Pumps. Probably the most elaborate turbine well pump catalog yet produced, its striking cover is of stippled gold with illustration in aqua-marine. Throughout, this catalog is profusely and ingeniously illustrated in color to vividly picture and explain the design, construction and operating features of Peerless Pumps in a novel manner of seeing what's under this-and-that insert flap, to reveal sectional views. Featured are the enclosed line shaft and water cooled drip-feed oil lubrication; bowl construction for sustained efficiency; Peerless Double Seal, assuring against sand cutting; lateral detector light and impeller adjustment. In the rear of the catalog is an impressive list of users of Peerless pumps and pictured is World's largest turbine pump. Some space is devoted to the Peerless Pump Testing Laboratories where deficiencies are corrected and efficiency born. In the rear appear 12 pages of Engineering and Hydraulics Data—much of which has never been published elsewhere and is definitely worth having. For a copy, write Peerless Pump Division (Food Machinery Corp.), 1900 East 67th Street, Los Angeles.

"American Aerators"—A recent 26-page bulletin from the American Well Works, Aurora, Ill., effectively describes the unique design and operating features of the American Mechanical Aerator for sewage treatment by the activated sludge process. The basic feature of the American Aerator is the central down

draft tube into which recirculated mixed liquor spills in air entraining films, to produce an effective emulsion of extremely minute air bubbles later forced into solution by the pressure at the bottom of the recirculating unit. Excellent descriptive pictures and drawings of the aerator unit and representative installations appear. Suggested specifications and a discussion of advantages of mechanical aeration are presented as is a list of installations and designing engineers of such plants. For a copy of "The American Aerator," write American Well Works, Aurora, Illinois.

"Turbine Deep Well Pumps"—From Fairbanks-Morse Company have come two new bulletins descriptive of their turbine pumps for deep wells. These illustrate and emphasize outstanding features of this type F.M. pumps, oil lubricated or water lubricated, in sizes 4 to 16 in. and capacities 10 to 2300 G.P.M., with lifts up to 400 feet. Such pumps are offered with F.M. motors or F.M. engine drive units, thus eliminating divided responsibility between manufacturer of pump and drive units. Featured are the enclosed impellers, metal bearings, enclosed line shaft, with highest quality bronze bearings for the oil lubricated type (Bul. 6920). On the water lubricated type (Bul. 6920 R) featured is the enclosed impeller bowl assembly, in combination with open line shaft column; high quality rubber bearings along line shaft, insuring vibrationless operation. For the companion bulletins 6920 and 6920 R, write Fairbanks Morse Company, Chicago.

"Possolithed Concrete Is Better Concrete"—From The Master Builders Company of Cleveland has come a brochure which provides an easy to follow presentation of what "Possolith" does in improving the workability and placeability of concrete; reducing shrinkage and surface checking, increased density and strength, and resistance to weathering or corrosion by the resulting concrete. "Possolith" is described as a ferric-alumino-silicate in liquid suspension. When added in proportions of 4 to 5 quarts to each cubic yard of concrete, one secret is the permissible reduction in water-cement ratios requisite for smooth pouring and void filling slurry. Contractors refer to it as "a concrete lubricant." Many pictures appear of representative "Possolithed" structures including retaining walls, dams, reservoirs (Allentown, et al.), important filtration plants (Milwaukee, et al.), sewage treatment plants (Rochester, et al.). An imposing list of representative jobs and testimonials also appear. For a copy of "Less Water —*yet*—More Placeability," write The Master Builders Co., 7016 Euclid Ave., Cleveland, Ohio.

"Super de Lavaud C.I. Pipe"—The U. S. Pipe and Foundry Company has just issued a new catalog, in color, tracing the history of Cast Iron Pipe since its early use (1864) in a water main to the newest development of the *tough* U. S. Super de Lavaud Pipe in 1933. Five distinctive advantages of the improved pipe and five reasons for its quality are set forth. Illustrated is the method of manufacture, followed by specifications and tables of dimensions and weights of the several classes (A.B.C.D.) for various working pressures. Then follow useful illustrated formula for calculating areas and volumes of rings, spheres, frustrums and the like. The new catalog supercedes the "U. S. Handbook of Super de Lavaud Pipe." For a copy write U. S. Pipe and Foundry Co., Burlington, N. J.

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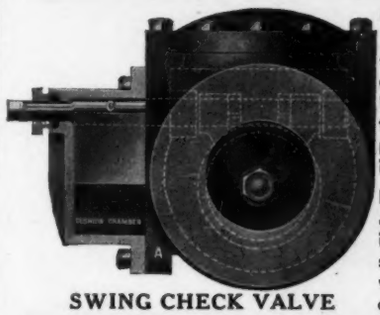
● ALTITUDE VALVE assures perfect water-level control in tanks, standpipes and reservoirs.

Always function without any water surge or shock due to efficient air and water cushioning.

Furnished with automatic, electric and manual control, and for single or double-acting service.



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● Cushioned Swing Check valve is non-slam due to perfect cushioning chamber. Minimum friction loss through valve and soon pays in power cost savings.

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FLOAT VALVE

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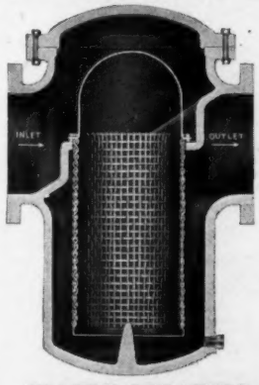

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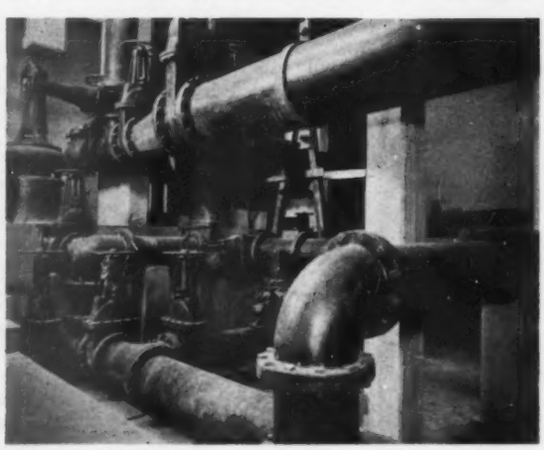

ACCOMPANYING photo shows Acipco pipe and fittings recently installed in new sewage disposal plant, Austin, Texas. In upper portion of the photo is the 18" return sludge line; in the lower portion are the 12" drain lines from clarifiers. In this and many other great modern sewage disposal plants, Acipco products were specified because of their exceptional quality and the unusually helpful service of the experienced Acipco organization. May we have an opportunity to quote on your next job? Address Acipco office nearest you.

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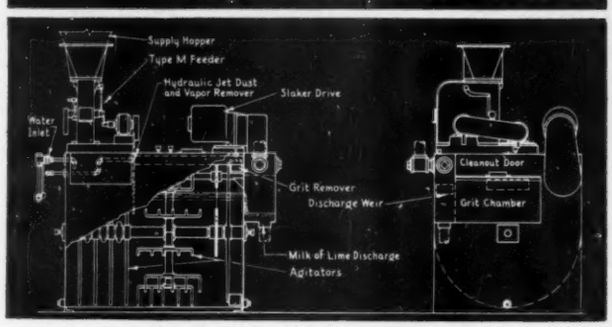

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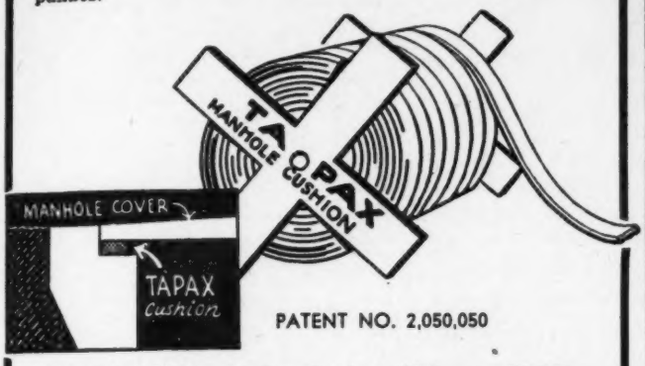

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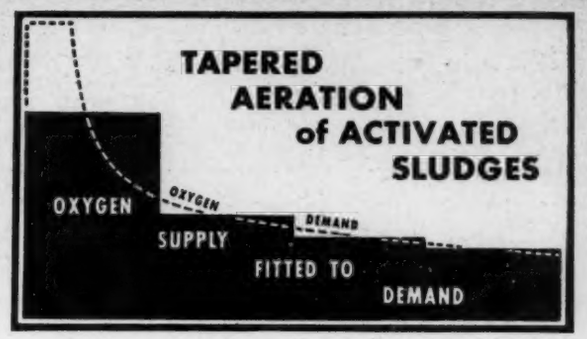

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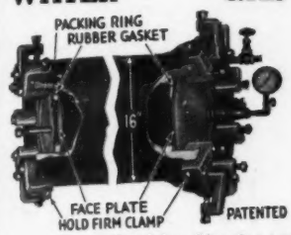

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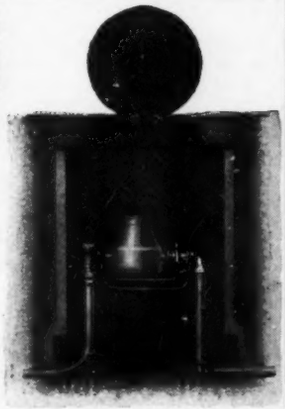

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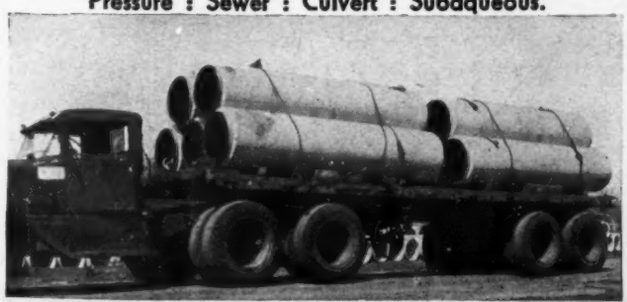

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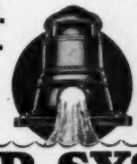

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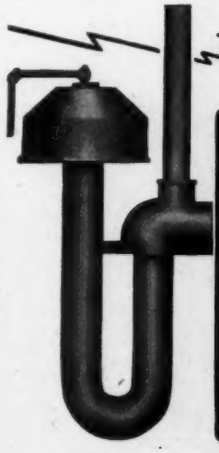

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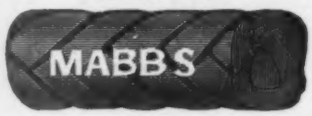

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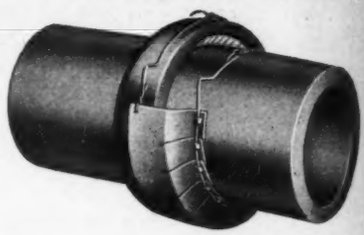

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Population	Designed for	40,000	
	Actual Contributing	28,000	
Raw Sewage Flow	Designed for—m.g.d.	3.00	
	Present—m.g.d.	2.13	
Raw Sludge	Moisture—percent	96.6	
	Volatile Solids—percent	71.0	
	Ash—percent	29.0	
Primary Digested Sludge	Moisture—percent	90.44	
	Volatile Solids—percent	40.5	
	Ash—percent	59.5	
Secondary Digested Sludge	Moisture—percent	74.2	
	Volatile Solids—percent	38.3	
	Ash—percent	61.7	
Reductions—Primary	Solid Matter—percent	51.3	
	Volatile Matter—percent	72.2	
Secondary	Solid Matter—percent	53.0	
	Volatile Matter—percent	74.7	
****Gas Production**	Per Day—cu. ft.	29,040	
	Per Capita Per Day—cu. ft.	1.04	
Overflow Liquor	Total Solids—percent	0.21	
	Suspended Solids—p.p.m.	409	
****Digester Temperatures**	Primary—Fahrenheit	90°	
	Secondary—Fahrenheit	79°	
Primary Digester Loading	lbs. of dry solids per cu. ft. per month	1.69	

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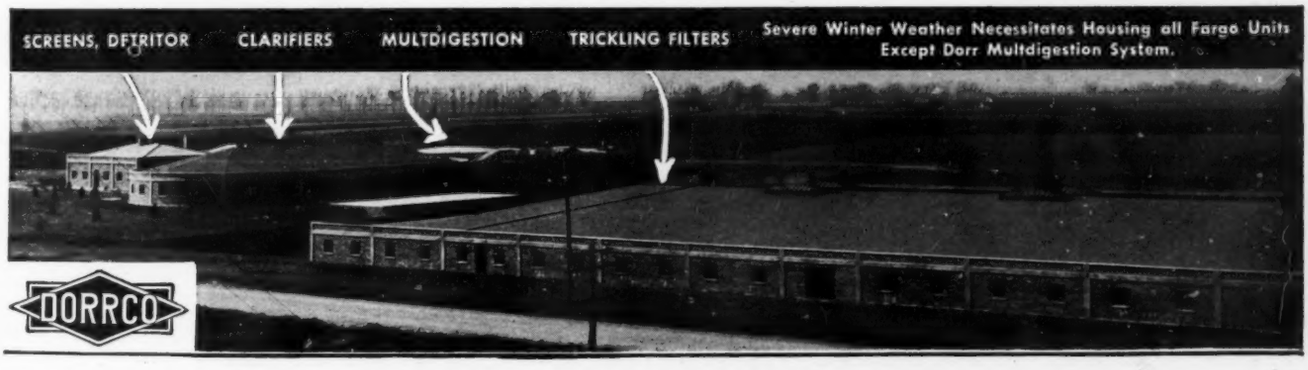
**Obtained through courtesy of Mr. W. P. Tarbell, City Engineer and Mr. F. W. Pinney, Plant Superintendent



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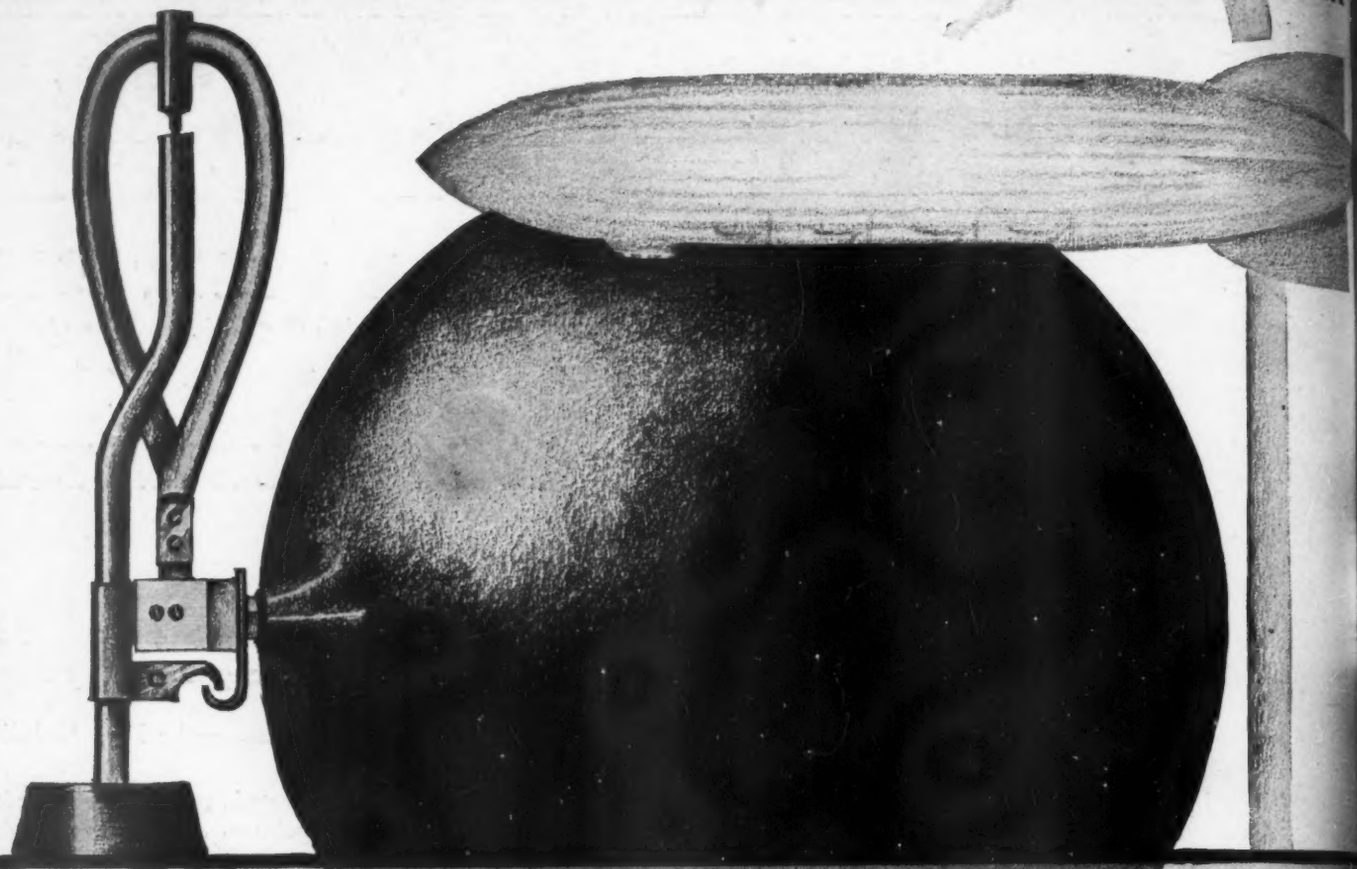

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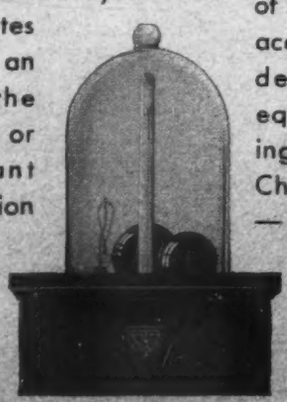

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